001199IE010301_CHI0865

Remedial Action 30% Design Report Jennison-Wright Wood-Preserving Site Granite City, Madison County, Illinois

Professional Services Agreement Number: FLS-1304
Amendment Number: 3

August 2002

Prepared for:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
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1 Introduction

E & E
Ecology and Environment Engineering of Illinois, P.C.

Illinois EPA
Illinois Environmental Protection Agency

JW
Jennison-Wright

RACM
regulated asbestos-containing material

NAPL
non-aqueous-phase liquids

Ecology and Environment Engineering of Illinois, P.C. (E & E) has prepared this 30% Design Report under contract to the Illinois Environmental Protection Agency (Illinois EPA). The report summarizes the rationale for the development of contract plans and specifications for a remedial action at the Jennison-Wright Wood-Preserving (JW) Superfund site in Granite City, Illinois. Remedial actions include:

- Demolition, transportation, and disposal of the transite building and foundation, including removal, transportation, and disposal of regulated asbestos-containing material (RACM);
- Removal, decontamination, and salvage of steel rail and the excavation, loading, transportation, and disposal of ties;
- Excavation, loading, transportation, and disposal of drip track residue (F032- and F034-listed waste);
- Excavation, loading, transportation, and disposal of dioxin-contaminated soils;
- Excavation, loading, transportation, and off-site disposal of soils with a cancer risk greater than 1E-4;
- Excavation, screening, and staging of soils with a cancer risk between 1E-4 and 1E-5;
- Construction of a land treatment unit for treatment of soils with a cancer risk between 1E-4 and 1E-5;
- Construction of an extraction system to remove non-aqueous-phase liquids (NAPL) from the aquifer in the vicinity of the 22nd Street Lagoon;

HRC®
Hydrogen Release Compound

RADR
Remedial Action Design Report

- In situ treatment of groundwater to reduce pentachlorophenol concentrations using Hydrogen Release Compound (HRC®);
- Installation of groundwater monitoring wells to monitor the groundwater remediation effort; and
- Collection, treatment, transportation, and disposal of decontamination and process water.

This document was prepared pursuant to Amendment 3 of Professional Services Agreement Number FLS-1304 and in accordance with the tasks specified in E & E's August 2000 Proposal Work Plan for the Remedial Design (E & E 2000a).

1.1 Purpose of the Design Report

The purpose of this 30% Design Report is to compile all functional and technical requirements and all provisions applicable to the remedial action for:

- Illinois EPA review and approval;
- Work plan assumptions and parameters, including functional restrictions;
- Outline of required specifications;
- Proposed siting/locations of construction activities;
- Initial requirements for equipment;
- Waste disposal requirements; and
- Permit requirement identification.

E & E will incorporate Illinois EPA comments on the 30% Design Report submittal into the ongoing Remedial Action Design Report (RADR) package and complete the plans and specifications addressing the various phases of this project. Any adjustments to the scope and direction of the project requested by Illinois EPA will be discussed and agreed upon between E & E and Illinois EPA so that any major revisions can be incorporated prior to submission of the 95% RADR documents. E & E will coordinate, check, and proof the plans and specifications for accuracy and completeness. In addition to all of the documentation provided in the 30% RADR, the 95% document submittal will also include:

- Initial capital cost estimate;
- Construction schedule;
- Construction quality assurance objectives; and
- Substantial requirements for contractor Health and Safety Plans (CHSPs).

CHSP
Contractor Health and Safety Plan

PWP
Proposal Work Plan

EE/CA
Engineering Evaluation/ Cost Analysis

Upon receipt of Illinois EPA comments on the 95% RADR, E & E will incorporate the comments and prepare and submit the final RADR documents to Illinois EPA. All RADR documents will be comprehensive and complete so that bidding packages can be prepared and provided to remediation contractors. The final RADR documents will include all of the 95% RADR documentation, revised as agreed upon with Illinois EPA, plus the final cost and construction-related items as follows:

- Final capital cost estimate;
- Final construction quality assurance objectives;
- Final construction schedule; and
- Substantial requirements for CHSPs.

Illinois EPA will hold the contract with the selected remedial action contractor(s). The CHSP(s) will be prepared by the remedial action contractor(s) selected to perform the tasks as required by the plans and specifications. The specifications prepared by E & E will state the requirements of the CHSPs.

This 30% Design Report is composed of 10 sections. Section 1 presents the introduction, purpose, and basis for development. Section 2 summarizes background information and gives an overview of the existing site conditions. Sections 3 and 4 delineate the NAPL Treatment Zone and the Groundwater Treatment Zone. Section 5 describes site preparation activities. Section 6 presents the proposed design of the treatment systems, and Section 7 describes the process equipment required. Operation and maintenance procedures are explained in Section 8. Section 9 describes additional considerations for the remedial action, and Section 10 is a list of the references used in this report.

1.2 Basis for the Design Report

The Proposal Work Plan for the Remedial Design (PWP; E & E 2000a) was based on the results of the Engineering Evaluation/ Cost Analysis (EE/CA; E & E 1999) that was prepared for the site. The RADR fits within the framework outlined in the PWP. Several of the tasks listed in the PWP were completed under the Limited Remedial Action. The Limited Remedial Action was conducted to facilitate the implementation of soil and groundwater treatment. This RADR serves the dual purpose of detailing tasks to enable preparation of Contract Plans and Specifications and serving as E & E's PWP.

2 Site Background

2.1 Site Description

The JW site, a 20-acre abandoned railroad tie-treating facility, is located at 900 West 22nd Street in Granite City, Illinois, approximately 6 miles northeast of downtown St. Louis, Missouri. The site is approximately 2 miles east of the Mississippi River, in Section 13, Township 3 North, Range 10 West, in Granite City, Madison County, Illinois.

The area surrounding the site is a mixed residential-industrial neighborhood. The site is bisected by 22nd Street, with former storage areas for untreated and treated wood located north of this street and the former facility process areas located south of the street. An Illinois-American Water Company waterworks facility is immediately north of the site. Railroad tracks border the site along its entire eastern boundary, and an alley and residences border the site along its entire western boundary.

2.2 Site Geology and Hydrogeology

The JW Site is located in an area often referred to as the American Bottoms. In the St. Louis metropolitan area, the Mississippi River occupies a deep bedrock valley that has been filled with both glacial outwash material and recent alluvium. The thickness of the valley fill is generally greater than 100 feet. In the Granite City area, the thickness is about 115 feet. The stratigraphy of the valley fill consists of silt, clay, sand, and gravel (Cahokia Alluvium). The upper 15 to 30 feet is commonly silt and clay with fine sand. Below this depth, the deposits vary from poorly graded to well-graded sands and gravels, grading to coarser sands and gravels that extend to bedrock. The bedrock in the area consists of Mississippian and Pennsylvanian limestones and dolomites with lesser amounts of shale and sandstone (Bergstrom and Walker 1956).

Major supplies of groundwater have historically been withdrawn from the valley fill material. Groundwater in the valley fill depos-

BGS
below ground surface

its occurs under water table (unconfined) conditions. The water table is generally found at depths ranging from 15 to 20 feet below ground surface (BGS). Groundwater flow is primarily south-southwest towards the Mississippi River, except in areas of high pumpage, which form large depressions in the water table. The bedrock in this area is considered a poor source of water primarily due to its low permeability and poor water quality (Bergstrom and Walker 1956).

2.3 Site History

The creosote process was the first wood-preserving process used at the site, and was in operation between the early 1900s and 1989. The creosote process equipment included three treatment cylinders; each was 6 feet in diameter with lengths from 96, 113, and 136 feet. In addition, there were three 28,000-gallon-capacity creosote working-tanks, various steam pumps, a compressor, a vacuum pump, and miscellaneous storage tanks.

The process involved pumping heated creosote (200°F) into a treatment cylinder that was filled with either railroad ties or wood blocks. Heat and pressure were applied to railroad ties for 3 to 4.5 hours. Blocks were heated for approximately one-half hour. The bulk of the creosote was then pumped back to the working tanks. A vacuum was applied to remove the remaining excess creosote, which was then also pumped back to the working tanks (E & E 1985).

At the conclusion of the treatment process, the cylinder door was opened, allowing residual creosote at the bottom of the cylinder to spill out onto the ground. Two in-ground cisterns were located at the rear of the cylinders. These cisterns collected creosote and surface water runoff that had accumulated in the pit. Steam pipes were placed throughout the pit area to heat the spilled creosote and increase its flow into the cisterns. The contents of the cisterns were then pumped into an aboveground creosote/water separator. Recovered creosote was returned to the working tanks (or a storage tank), and the water was discharged to the municipal sewer system. As the creosote in a working tank was used, makeup creosote was added from two 160,000-gallon tanks located north of the cylinders. These two tanks were removed from the site in 1995.

Wood ties and blocks were transported before and after treatment in small-gauge trams. The rails for the tramway were situated throughout the facility, primarily between the treatment areas on the south side of the site and the storage areas on the north side of the site. Surficial soil contamination resulted from creosote dripping from treated ties and blocks during transportation to storage areas (E & E 1985).

PCP
pentachlorophenol

PDC
Peoria Disposal Company

The pentachlorophenol (PCP) process was used at the site from 1960 until 1986. Decorative wood blocks for flooring were treated with a preservative made up of a light petroleum distillate base and 5% PCP. Process equipment included a 17,000-gallon treatment cylinder, a 15,000-gallon working tank, a storage tank, a compressor, and a vacuum pump. The process involved placing wood blocks carried on trams into the treatment cylinder, which was then filled with the PCP solution. Once the cylinder was full, PCP solution was forced back into the working tank by pressurizing the cylinder. Following pressurization, the cylinder was drained, and a vacuum was applied to the cylinder for 2.5 hours to draw out excess PCP solution. Air pressure was again applied to drain the remaining PCP solution. At the conclusion of the treatment process, the cylinder door was opened and the trams were pulled out of the cylinder. The residual PCP solution at the bottom of the cylinder was allowed to spill out onto the ground (E & E 1985; WCC 1988).

The PCP treatment cylinder and storage tanks were located on the south side of the site approximately 30 feet from the west boundary of the plant. PCP solution was used at an average rate of 15,000 gallons per year, although this quantity fluctuated depending on demand (E & E 1985).

In 1986, the PCP process was replaced with a zinc naphthenate process. The equipment and the area used for the zinc naphthenate process were the same as those used in the PCP process.

In 1987, the creosote treating area was retooled and modernized, the old riveted-seam cylinders of the creosote-treatment process were removed and replaced with modern welded-seam cylinders. The replacement involved the removal of the cylinders, cisterns, and contaminated soil. Near the cisterns, soil was excavated to a depth of several feet below the ground surface. A concrete containment structure (i.e., the concrete basin) was built in the excavation, followed by the installation of the new cylinders. A new tank farm was constructed within the concrete containment structure, and the previously used tanks were demolished. All contaminated soils removed from the excavation were disposed of off site as hazardous waste at the Peoria Disposal Company (PDC) Landfill in Peoria, Illinois (WCC 1988). The replacement of the creosote treating area was performed without Illinois EPA approval.

Visibly contaminated soils within the excavation were covered with concrete.

In addition to wood treatment, Jennite was produced at the site. Jennite was a coal tar pitch product used commercially as a pavement sealant. The basic components were montmorillonite clay, coal tar pitch, and a latex/rubber compound. The product was manufactured at the facility beginning in the early 1960s (E & E 1985). The Jennite process involved two 35-foot-tall storage silos, assorted mixing chambers, and an emulsion process that used three heated tanks. Coal tar pitch and a latex/rubber compound were heated to form an emulsion base. This base was then mixed with the clay to make Jennite, which was then packaged and stored in 55-gallon steel drums. The Jennite product was also packaged in 5-gallon containers for retail sale. In 1989, the Jennite operations ceased. The two silos still exist on site, and still contain montmorillonite clay.

In 1989, the Jennison-Wright Corporation declared bankruptcy, and wood treatment operations ceased. In 1990, the JW site closed and some of the treatment cylinders, tanks, and rails were salvaged. Between 1990 and 1995, the site was plagued with trespassing, trash disposal, and occasional vandalism. In 1995, the windows and doors of the office building were covered with plywood. However, people continue to illegally dispose of trash on site by tossing it over the site fence, especially along the west boundary.

2.4 Summary of Previous Site Investigations

WCC
Woodward Clyde Consultants

In 1988, Woodward Clyde Consultants (WCC) completed a site assessment as part of a Judicial Consent Decree between the Jennison-Wright Corporation and the State of Illinois signed on January 15, 1986. The results of the site assessment indicated that soil underlying the site consisted of seams of clayey and sandy soils within the upper 25 feet. Sandy and gravelly soils were encountered below 25 feet extending to bedrock. Groundwater was encountered at a depth of approximately 17 feet BGS, and was found to flow in a southwesterly direction across the site.

Subsurface contamination was found by WCC in both soil and groundwater at the JW site. Soil contamination was noted both visually and analytically through the unsaturated zone to groundwater, near the 22nd Street lagoon, the Jennite pit, and the PCP process area. All of these areas are located south of 22nd Street. Soil contamination in the remainder of the site was found to depths ranging from less than 1 foot to 5 feet BGS. Groundwater contamination was found to be localized in shallow monitoring wells in the three previously mentioned areas where soil contamination extended to groundwater, i.e., the 22nd Street lagoon, the Jennite pit, and the PCP treatment area. Groundwater contamination was not found in the one intermediate or the four deep wells at the site.

OVA
organic vapor analyzer

ACM
asbestos-containing material

PAHs
polynuclear aromatic hydrocarbons

In 1991, Illinois EPA completed six soil borings at the JW site in order to determine the horizontal and vertical extent of contamination in three on-site areas. Two borings were completed in each area of concern: the northeast corner of the site, the 22nd Street lagoon, and the Jennite Pit. Each boring was sampled continuously and advanced to, or just below, the water table. Soils were logged by a geologist, and each sample interval was screened for organic vapors using an organic vapor analyzer (OVA). No soil samples were submitted to a laboratory for chemical analysis.

Soil samples from all six borings showed visible signs of contamination, as well as, discolored oily groundwater contamination. Borings completed in the northeast corner and the 22nd Street lagoon exhibited gross soil contamination throughout the entire boring length, with OVA meter readings between 100 and greater than 1,000 units. For the borings completed at the Jennite Pit, contamination was visible at the surface, but appeared to decrease at depths of 4 to 6 feet. No OVA readings were observed until just below the water table, where soils exhibited meter readings greater than 1,000 units.

From July through September 1997, and in December 1997, E & E conducted sampling in support of the preparation of the EE/CA report. The investigation included a site reconnaissance, a site survey, surface and subsurface soil sampling, a hydrogeologic investigation, a bench-scale biofeasibility study, a structures investigation, sediment sampling, and sampling of suspect asbestos-containing material (ACM). The EE/CA investigation found:

- The presence of dioxins/furans and carcinogenic polynuclear aromatic hydrocarbons (PAHs) in site surface soils;
- The presence of PCP in groundwater in the PCP process area, and the presence of carcinogenic PAHs, benzene, PCP, arsenic, 2, 4-dimethylphenol, 2-methylphenol, and naphthalene in groundwater at the 22nd Street lagoon;
- The presence of benzene and naphthalene in subsurface soil;
- Structurally unsound on-site buildings and silos; and

RACM
regulated asbestos containing material

ROD
Record of Decision

EO
Environmental Operations, Inc.

HDPE
high-density polyethylene

- Four on-site buildings containing Regulated ACM (RACM).

The results of the EE/CA were reported to the Illinois EPA in July 1999. This report formed the basis of the JW Record of Decision (ROD).

2.5 Previous Removal Actions

Under contract with the Illinois EPA, the firm of RIEDEL, of Chesterfield, Missouri, performed two removal actions at the JW site.

In May 1992, RIEDEL and its asbestos removal subcontractor, Environmental Operations, Inc. (EO), performed a removal action at the site under the direction of Illinois EPA. During this effort, the following work was accomplished:

- 22 cubic yards of ACM was removed from several piles on site, and transported to the Litchfield/Hillsboro Landfill in Montgomery County, Illinois, for disposal;

- An additional fifteen 55-gallon drums of ACM contaminated with creosote were moved into the site's transite building;

- One hundred twenty-one 55-gallon drums of unknown contents that were located throughout the site were moved to the transite building;

- 1,300 gallons of creosote-contaminated water was pumped to the west 160,000-gallon aboveground storage tank;

- Creosote, tar, and contaminated soil that had migrated off site from the Jennite pit along the site's eastern fence line were excavated and placed into three cutoff tanks located east of the site's green building for temporary storage; and

- The three cutoff tanks were covered with wooden lids and high-density polyethylene (HDPE) geomembrane liners (RIEDEL 1992).

RIEDEL and EO completed the above work on May 28, 1992.

On November 8, 1994, RIEDEL initiated a second removal action at the JW site. This removal implemented the action recommended in the 1994 EE/CA report, a previous document prepared by E & E. The objective of the 1994 EE/CA investigation and report was to focus on the most significant sources of contamination present on site (i.e., drums and tanks). After completion of the 1994 EE/CA report, a public meeting was held to discuss the report's recommendations, an Action Memorandum was prepared to address public comments, and technical specifications were prepared by E & E for the removal action.

During this second removal action, RIEDEL performed the following work:

- A 100-foot by 150-foot crushed stone support zone was constructed just inside the fence on the south side of 22nd Street and west of the JW office building;
- The two 160,000-gallon aboveground tanks located south of 22nd Street and east of the JW office building were dismantled, cleaned, and scrapped. Five hundred cubic yards of sludge from these tanks was solidified and disposed of off site at the Chemical Waste Management of Indiana, Inc. facility located in Fort Wayne, Indiana;
- An aboveground railcar located north of 22nd Street was dismantled, cleaned, and disposed of;
- A buried railcar located south of 22nd Street and west of the 22nd Street lagoon was excavated, dismantled, cleaned, and disposed of;
- The three cutoff tanks located in the former creosote-process area were emptied, dismantled, cleaned, and disposed of. A large amount of sludge from these tanks was solidified and disposed of off site at the Chemical Waste Management of Indiana, Inc. facility located in Fort Wayne, Indiana;
- A total of 49,530 gallons of water removed from the above-mentioned tanks and railcars was treated on site and discharged to the Granite City sanitary sewer system;
- A total of 183 drums of soil was solidified and disposed of off site;
- Chain-link fencing 450 feet long was installed around an isolated area (Area H) in the far northeast corner of the site;
- An engineered cap consisting of a 40-mil HDPE liner and a vegetated cap was constructed over the Jennite pit; and

Bodine
Bodine Environmental Services, Inc.

ASTs
aboveground storage tanks

USTs
underground storage tank

- Miscellaneous debris collected from across the site was stockpiled along the eastern property fence line to the north of the transite building.

RIEDEL demobilized from the site during the week of March 6, 1995.

Under contract with the Illinois EPA, the firm of Bodine Environmental Services, Inc. (Bodine), of Decatur, Illinois, will perform a limited removal action at the JW site. In late 2002, Bodine will mobilize to the site and perform the following work:

- A permanent decontamination pad will be constructed on the south portion of the site;
- All of the on-site buildings and associated ACM (with the exception of the transite building), sumps, pits, silos, and foundations will be demolished with the debris being transported off site for disposal;
- Debris piles will be transported off site for disposal; and
- Aboveground storage tanks (ASTs), underground storage tanks (USTs), and the oil/water separator will be cleaned, dismantled, and transported off site for disposal.

Ultimately, this limited remedial effort will prepare the site for the implementation of the large-scale, long-term remedial effort.

2.6 Scope of Final Remedial Action

The alternatives selected in the July 1999 EE/CA for the JW site address final remedial actions for mitigating the present sources of contamination. Based on Illinois EPA's scope of work, the Remedial Action shall include:

- Removal and disposal of hazardous waste along the drip tracks;
- Plans and specifications to treat contaminated soil;
- Plans and specifications for a NAPL removal and groundwater treatment system;
- Plans and specifications for an in situ biological treatment system to treat groundwater;

- Asbestos abatement and building demolition; and

- Removal of debris piles, storage tanks, abandoned steel trams, and sumps and pits at the site.

CUOs
clean-up objectives

SRE
Streamlined Risk Evaluation

EPA
United States Environmental Protection Agency

MCL
maximum contaminant level

The Limited Remedial Action addressed several of the above tasks. The selected tasks helped to facilitate the implementation of the larger-scale items (i.e., soil and groundwater treatment). This final remedial design will be a comprehensive set of specifications designed to meet the clean-up objectives (CUOs) established in the ROD for the JW site. The CUOs were calculated using the results of the Streamlined Risk Evaluation (SRE), conducted during the July 1999 EE/CA. The soil CUOs represent the 10^{-5} risk level for carcinogens, and a Hazard Quotient of 1 for noncarcinogens for the permanent site worker and construction worker scenario. Based on United States Environmental Protection Agency (EPA) guidance documents, the CUO for dioxin (TCDD-TEF) in soil was established. The groundwater CUOs represent the 10^{-6} level for carcinogens and a Hazard Quotient of 1 for noncarcinogens, or the maximum contaminant level (MCL), using a similar site worker and construction worker exposure scenario.

The selected remedies may be modified or refined, subject to the approval of Illinois EPA and E & E. Such modifications or refinements, if any, would generally reflect the results of the pre-design treatability studies or engineering design process, or newly promulgated regulations addressing a remedial action component, contaminant, or other circumstance at the site.

3 Delineation of NAPL Treatment Zone

3.1 Estimation of NAPL Area

The EE/CA prepared for the JW site identified the presence of a NAPL plume within the area of the 22nd Street Lagoon. Subsequently, the ROD issued for the JW site mandated that NAPL be removed. In order to properly size a NAPL extraction system, additional data was needed to properly define the extent of contamination. Therefore, a predesign investigation was performed to determine the approximate horizontal and vertical extent of NAPL contamination. The following subsections summarize the findings of the predesign investigation and define the boundaries, which will serve as the design basis for the proposed NAPL remedial effort.

3.2 Summary of Pre-Design Investigation

During the week of April 16, 2001, seven continuously sampled rotasonic borings were conducted in accordance with the work plan submitted to the Illinois EPA (E & E 2000b). Figure 3-1 depicts the boring locations.

Clay was encountered in portions of the upper 20 feet of all seven borings, which was consistent with previous investigations for the 22nd Street Lagoon area. Visually, the clay appeared to be acting as a confining layer to surface spills. However, at SB-44, black oil stringers penetrated the entire thickness of the clay. At other borings, either the clay was stained or had a distinctive olive discoloration, which indicated that it was not thick enough and/or sufficiently impermeable to prevent the downward migration of contaminants. Starting at 22 feet BGS, all borings encountered sand or gravel to bedrock. Therefore, low-permeability units are not present below 22 feet BGS to prevent vertical migration of contaminants.

Based on visual observations, SB-45 was the most heavily impacted boring. It contained the greatest cumulative thickness (68 feet) of residual NAPL. Of the seven borings, residual NAPL was observed at the greatest depth in this boring. The residual oil was present intermittently to a depth of 101 feet BGS. NAPL was not observed from 101 feet BGS to 113.5 feet BGS, but it reappeared as a 1-foot interval at the limestone bedrock sand and gravel contact.

A solid interval of bedrock was not recovered from any of the borings due to the type of drill bit used. The bit was chosen to maximize the recovery of sand (which was still sometimes difficult to recover) and was not appropriate for penetrating bedrock. The bedrock was extremely hard and therefore very unlikely to be fractured. NAPL penetration beyond the sand and gravel bedrock contact was determined to be unlikely. With the exception of SB-45, NAPL was not observed on top of the bedrock at any of the other six borings.

In addition to SB-45, three other borings were heavily impacted with residual NAPL. SB-44, SB-46, and SB-47 had 47, 39, and 30 feet of residual NAPL cumulative thickness, respectively. Residual NAPL was present in SB-42 at two horizons within the 51-foot-BGS to 64-foot-BGS depth interval. These distinct horizons of NAPL were observed although there was no apparent change in lithology. Although grain size and permeability may have influenced the migration of the NAPL, it was not visually apparent that these parameters were controlling the distribution of NAPL. The residual NAPL at SB-49 was restricted to one interval starting at 14 feet BGS in the vadose zone, and extending past the water table to 21 feet BGS. No residual NAPL was observed in SB-43.

3.2.1 Analytical Results

Five soil samples were collected from depths ranging from 50 to 100 feet BGS. Additionally, groundwater samples were collected from MW-5S and MW-5D. The samples were submitted to E & E's Analytical Service Center (ASC) for analysis. Tables 3-1 and 3-2 provide a summary of the analytical results.

ASC
Analytical Services Center

FID
flame ionization detector

PID
photoionization detector

The basis of selection of an interval for collecting a soil sample was visual staining and depth. Typically, the most heavily impacted interval was chosen, provided it was 50 or more feet BGS. Frequently, the maximum flame ionization detector (FID)/photoionization detector (PID) reading at a given boring coincided with observed residual NAPL but not with the interval that was most visually impacted. At each boring, the maximum FID reading and the maximum PID reading rarely occurred at the sample interval. The highest FID/PID readings were found in the upper half of the borings, which correlates with the groundwater analytical results in that several VOCs were detected in the groundwater sample from the shallow well (MW-5S) and no VOCs were detected in the groundwater sample from the deep well (MW-5D).

TACO
Tiered Approach to Corrective Action Objectives

WRI
Western Research Institute

PAH compounds were detected in most of the soil samples at concentrations that exceed the soil migration to groundwater pathway criteria, established by the Tiered Approach to Corrective Action Objectives (TACO). Depending on the sample, from three to seven PAH compounds were present at concentrations exceeding the soil to groundwater criteria. In comparison, many of the PAH compounds detected in the soil were also detected in the groundwater sample collected from MW-5D. Only two PAH compounds were detected at concentrations that exceed the TACO groundwater remediation objectives. This indicates that the PAH contaminants are more tightly bound to the soil than the TACO approach predicts.

3.2.2 Thermodynamic Properties of NAPL

In addition to submitting soil and groundwater samples for chemical analysis, a sample of the NAPL was collected and submitted to Western Research Institute (WRI) to determine the viscosity of the NAPL at various temperatures. Table 3-3 provides a summary of the results. The data show that as the temperature of the NAPL is increased, its viscosity decreases. It should be noted that at a temperature of 150^{O} F, the specific gravity of the NAPL is still greater than 1. This means that the NAPL is still denser than water, and will have a tendency to migrate downward (i.e., sink).

3.3 Proposed Design Criteria

Using the data from the EE/CA and pre-design investigation, the horizontal extent of contamination was estimated to encompass an area approximately 190 feet by 150 feet. Figure 3-1 delineates the area.

In order to determine the approximate vertical extent of contamination, cross sections based on subsurface soil data were developed (Figures 3-2 and 3-3). The cross sections show that the NAPL does not exhibit consistent lateral correlation. There is no horizon where NAPL is present in all of the heavily impacted borings. This supports a conceptual model in which the residual NAPL is present as immobile semi-isolated masses, droplets, and stringers. It is likely that the subsurface NAPL is trapped at residual saturation in pockets, although not at sufficient quantities to exist as pools. The discontinuous nature of residual NAPL is a common observation at many different NAPL-containing sites.

The naphthalene data best illustrate the strongly sorbed/immobile nature of the contaminants in the soil. Naphthalene was detected in a soil sample at over 40 times the migration to groundwater criteria. In the same general area, naphthalene was detected in the groundwater sample from MW-5D at a concentration that is six times less than the groundwater remediation objective. Therefore, the naphthalene does not appear to be dissolving into the groundwater at the concentrations that the TACO approach would predict.

Based on the analytical results provided by WRI, as the temperature of the subsurface increases, the viscosity of the NAPL will decrease. However, the specific gravity of the NAPL will not decrease sufficiently to allow it to rise within the water column. With the increase in mobility and a specific gravity greater than 1, there is the potential for the NAPL to migrate downward. In order to prevent this, it is proposed that the NAPL extraction system address an area from the water table down to a depth of approximately 90 feet BGS. While at one boring, SB-45, NAPL was detected at a depth of greater than 90 feet, groundwater samples collected during the pre-design study indicate that limited groundwater contamination is present. Additionally, the purpose of the NAPL extraction system is not to achieve CUOs, but to remove a sufficient volume of NAPL to allow for the implementation of a less costly in situ remedial option.

In summary, the NAPL extraction system will address a surface area of 190 feet by 150 feet, and from the water table to a depth of 90 feet BGS.

TABLE 3-1 SUMMARY OF SOIL ANALYTICAL RESULTS
SEMIVOLATILE ORGANIC COMPOUNDS
30% REMEDIAL DESIGN
JENNISON-WRIGHT SUPERFUND SITE
GRANITE CITY, ILLINOIS

	Sample ID:		SB42	SB44	SB45	SB45D	SB46	SB49	SB47	SB43
	Sample Depth (ft BGS):		(52-57)	(52-57)	(100-101)	(100-101)	(56-61)	(12-17)	(72-77)	(52-57)
	Sample Date:		4/17/2001	4/18/2001	4/19/2001	419/01	4/20/2001	4/19/2001	4/21/2001	4/21/2001
Compound (μg/Kg)	**ROD CUO**	**TACO CUO[a]**								
2,4-Dimethylphenol	N.E	9,000	N.D.	N.D.	N.D.	N.D.	N.D.	**16,300** J	N.D.	N.D.
2-Methylnapthalene	N.E	N.E.	156,000 J	422,000 J	347,000 J	502,000 J	395,000	1,020,000	53,000 J	N.D.
Acenaphthene	N.E	570,000	320,000 J	**1,390,000**	494,000 J	**691,000**	544,000	**930,000**	182,000	N.D.
Acenaphthylene	N.E	N.E.	N.D.	154,000 J	69,100 J	95,500 J	58,500 J	219,000 J	N.D.	N.D.
Anthracene	N.E	12,000,000	161,000 J	625,000 J	205,000 J	293,000 J	233,000	547,000	73,300	N.D.
Benz(a)anthracene	14,000	2,000	**128,000** J	**525,000** J	**185,000** J	**264,000** J	**141,000** J	**504,000**	**53,800** J	N.D.
Benzo(a)pyrene	2,000	8,000	**64,000** J	**273,000** J	**94,900** J	**133,000** J	**69,900** J	**265,000** J	**26,900** J	N.D.
Benzo(b)fluoranthene	22,000	5,000	N.D.	**214,000** J	**96,400** J	**126,000** J	**67,400** J	**210,000** J	**24,500** J	N.D.
Benzo(g,h,I)perylene	N.E	N.E.	N.D.	N.D.	N.D.	N.D.	345,000 J	94,200	N.D.	N.D.
Benzo(k)fluoranthene	32,000	49,000	N.D.	**289,000** J	**87,200** J	**132,000** J	**67,500** J	**112,000**	31,000 J	N.D.
Bis(2-ethylhexyl)phthalate	N.E	N.E.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	71 J
Carbazole	954,000	600	N.D.	199,000 J	85,000 J	123,000 J	121,000 J	280,000 J	27,200 J	N.D.
Chrysene	N.E	160,000	118,000 J	452,000 J	161,000 J	**226,000** J	135,000 J	395,000	56,000 J	N.D.
Dibenz(a,h)anthracene	2,000	2,000	N.D.	N.D.	N.D.	N.D.	N.D.	**61,200**	N.D.	N.D.
Dibenzofuran	N.E	N.E.	220,000 J	897,000 J	343,000 J	487,000 J	378,000	754,000	132,000	N.D.
Fluoranthene	N.E	4,300,000	522,000	2,000,000	787,000	1,100,000	776,000	1,780,000	248,000	N.D.
Fluorene	N.E	560,000	331,000 J	**1,290,000**	468,000 J	**679,000**	484,000	**1,060,000**	173,000	N.D.
Indeno(1,2,3-cd)pyrene	11,000	14,000	N.D.	N.D.	N.D.	N.D.	**36,100** J	**140,000** J	N.D.	N.D.
Naphthalene	27,000	84,000	**647,000**	**3,560,000**	**1,690,000**	**2,400,000**	**2,360,000**	**3,350,000**	**276,000**	N.D.
Phenanthrene	N.E	N.E.	1,090,000	3,880,000	1,470,000	2,070,000	1,560,000	3,290,000	548,000	N.D.
Pyrene	N.E	4,200,000	349,000 J	1,340,000	535,000	754,000	502,000	1,300,000	218,000	N.D.

[a] CUO is based on Class I soil component to groundwater

Key:

ft = Feet.
BGS = Belowground surface.
μg/Kg = Micrograms per kilogram.
TACO = Tiered Approach to Corrective Action.
CUO = Cleanup objective.
ROD = Record of decision.
N.D. = Not detected.
J = Estimated concentration.
N.E. = Not established.

TABLE 3-2 SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
30% REMEDIAL DESIGN
JENNISON-WRIGHT SUPERFUND SITE
GRANITE CITY, ILLINOIS

Compound	Sample Location:	MW-5S	MW-5D	Trip Blank
	Sample Date:	4/22/2001	4/22/2001	4/22/2001
	ROD CUO			
Volatile Organic Compounds (μg/L)				
2-Butanone	N.E.	10.5	N.D.	N.D.
2-Hexanone	N.E.	3.03 J	N.D.	N.D.
2-methyl-2-pentanone	N.E.	10.2	N.D.	N.D.
Acetone	N.E.	49.9	N.D. J	5.39 J
Benzene	10	**839**	N.D.	N.D.
Ethylbenznene	N.E.	80.2	N.D.	N.D.
m,p-Xylene	N.E.	187	N.D.	N.D.
o-Xylene	N.E.	86.3	N.D.	N.D.
Styrene	N.E.	67.7	N.D.	N.D.
Toluene	N.E.	414	N.D.	1.23 J
Trichloroethene	N.E.	1.01 J	N.D.	N.D.
Semivolatile Organic Compounds (μg/L)				
2,4-Dimethylphenol	200	**14,500**	N.D.	N.A.
2-Methylnaphthalene	N.E.	675 J	N.D.	N.A.
2-Methylphenol	500	**9,820**	N.D.	N.A.
4-Methylphenol	N.E.	23,700	N.D.	N.A.
Acenaphthene	N.E.	500 J	176	N.A.
Acenaphthylene	N.E.	N.D.	17.9	N.A.
Anthracene	N.E.	N.D.	14.5	N.A.
Benz(a)anthracene	0.13	N.D.	**5.38** J	N.A.
Benzo(a)pyrene	N.E.	N.D.	2.22 J	N.A.
Carbazole	N.E.	N.D.	39	N.A.
Chrysene	4	N.D.	**4.86** J	N.A.
Fluoranthene	N.E.	N.D.	48.9	N.A.
Fluorene	N.E.	N.D.	105	N.A.
Napththalene	400	**16,300**	4.05 J	N.A.
Phenanthrene	N.E.	N.D.	167	N.A.
Phenol	N.E.	16,900	N.D.	N.A.
Pyrene	N.E.	N.D.	38.6	N.A.

Key:

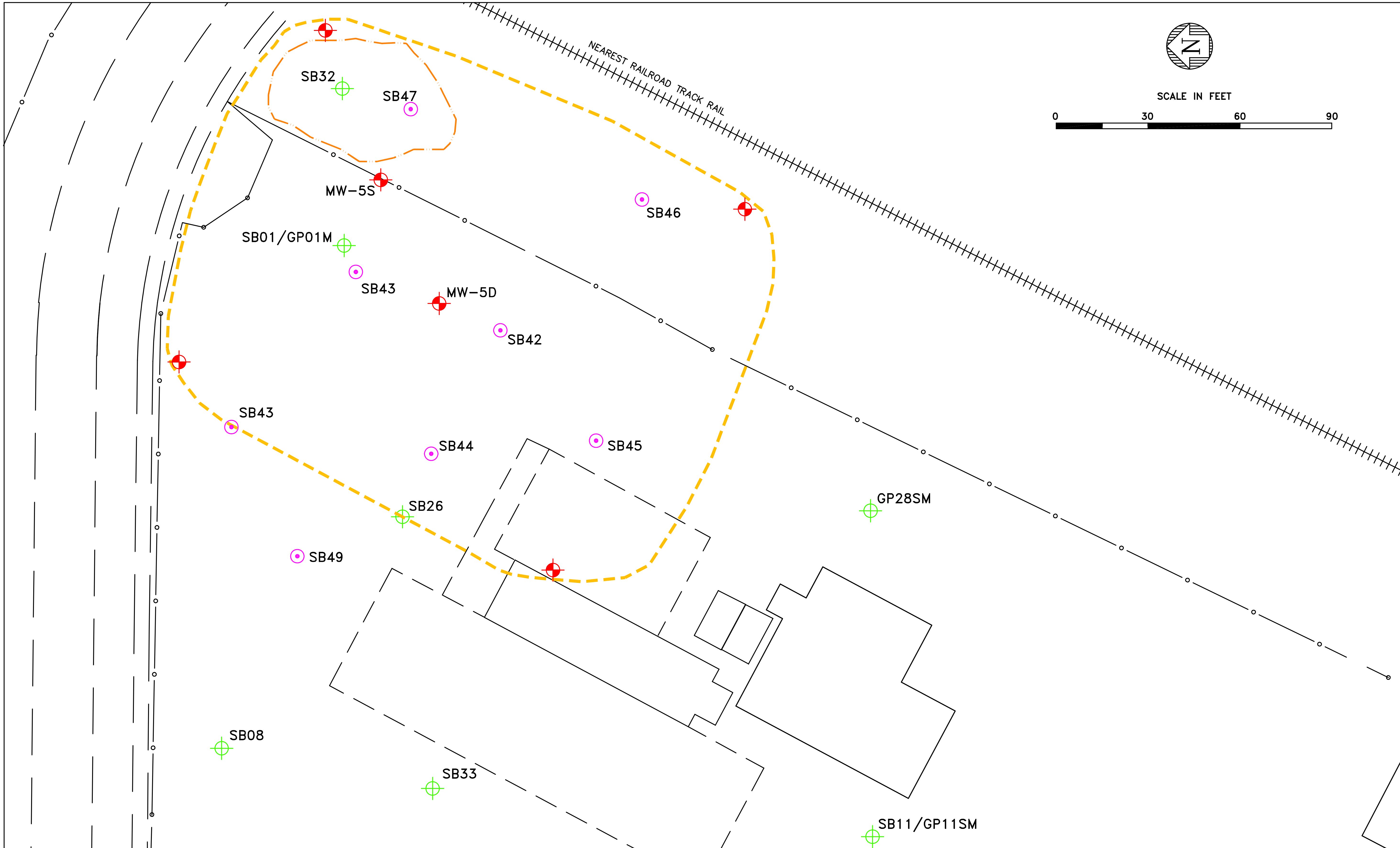
μg/L = Micrograms per liter.
TACO = Tiered Approach to Corrective Action.
CUO = Cleanup objective.
ROD = Record of decision.

Table 3-3 SPECIFIC GRAVITY AND VISCOSITY ANALYTICAL RESULTS
30% REMEDIAL DESIGN
JENNISON-WRIGHT SUPERFUND SITE
GRANITE CITY, ILLINOIS

Temperature (^oF)	Specific Gravity	Density (g/cc)	Viscosity (SUS)	(CST)	(cp)
70	1.0787	1.0765	107	22.21	23.9
100	1.0715	1.064	62.4	11.01	11.7
150	1.0647	1.0436	41.1	4.54	4.73

Key:

^oF = Degrees fahrenheght.
g/cc = Grams per cubic centimeter.
SUS = Sybolt universal seconds.
CST = Centistokes.
cp = Centipoise.



LEGEND:

PREVIOUS SOIL BORING AND GEOPROBE SAMPLING LOCATION

EXISTING MONITORING WELL LOCATION

ROTASONIC DRILLING LOCATION

ESTIMATED NAPL AREAL EXTENT

FORMER 22ND STREET LAGOON (WOODWARD-CLYDE 1988)

EXISTING STRUCTURES AND FEATURES

FORMER STRUCTURES AND FEATURES

FENCE

ecology and environment engineering of illinois, p.c.
International Specialists in the Environment

DESIGNED BY: R. SLAUGHTER	CHECKED BY: R. HACKLER
DRAWN BY: R. SLAUGHTER	APPROVED BY: N. BROWN

FIGURE 3-1
22nd STREET LAGOON PRE-DESIGN INVESTIGATION
SOIL BORING LOCATION MAP

JENNISON-WRIGHT SITE
GRANITE CITY, ILLINOIS

SCALE	DATE ISSUED	C.A.D. FILE NO.	DRAWING NO.	REV.
1"=30'	JUN 2001	IE1S001B_3-1	1199.IE01 — 1	0

CHI plotted: 11/14/2000 RES

ecology & environment, inc.

Figure 3-2 CROSS SECTIONAL AREA 22ND STREET LAGOON
30% REMEDIAL DESIGN
JENNISON-WRIGHT SITE
GRANITE CITY, ILLINOIS

ecology & environment, inc.

Figure 3-3 CROSS SECTIONAL AREA 22ND STREET LAGOON
30% REMEDIAL DESIGN
JENNISON-WRIGHT SITE
GRANITE CITY, ILLINOIS

4 Delineation of Groundwater Treatment Zone

µg/L
micrograms per liter

Regenesis
Regenesis, Inc.

ORC®
Oxygen Release Compound

EFS
Environmental Field Services, Inc.

The JW EE/CA determined that the majority of site groundwater contained PCP at concentrations that exceeded the MCL of 1 microgram per liter (µg/L). The EE/CA determined and the ROD subsequently mandated that the use of an in situ biodegradation compound be implemented to reduce the PCP groundwater concentrations in those areas that do not have NAPL present. The EE/CA identified the use of Regenesis, Inc. (Regenesis) Oxygen Release Compound (ORC®) to facilitate the aerobic degradation of PCP.

During the pre-design phase, a pilot test was conducted to ensure that an in situ application of a release compound could actually stimulate the natural occurring microbes to facilitate degradation of PCP contamination. As the pilot test protocols were being developed, E & E determined that anaerobic degradation would be more suitable for addressing chlorinated compounds than the aerobic conditions generated by injecting ORC. Therefore, E & E conducted the pilot test using Regenesis' Hydrogen Release Compound (HRC®).

The following subsections summarize the HRC® pilot test and provide the proposed treatment area.

4.1 Groundwater

On June 19, 2001, Environmental Field Services, Inc. (EFS) under subcontract with E & E, mobilized to the JW site to perform the HRC® injection. Seven injections were performed, and approximately 150 pounds of HRC® was injected at each location. Figure 4-1 provides the location of the injections and sampling points for the pilot test.

The injection points form two rows of HRC® sites, which are upgradient of MW-8S and perpendicular to groundwater flow. The center points of the rows are approximately 3 and 5 feet up-gradient from MW-8S. One hundred and fifty pounds of HRC® was injected from 27 feet BGS to 17 feet BGS at each injection point.

The HRC® was injected into the saturated zone through steel rods using a piston pump. Specifically, a Geoprobe direct-push system and high-pressure piston-driven grout pump was used to inject the HRC®. A steel probe rod fitted with an expendable tip was advanced to the proposed depth of 27 feet BGS. The probe rod was slightly retracted to dislodge the expendable tip from the probe rod. The HRC® was then pumped through the open-ended probe rod into the soil as the rod was retracted. The rods were completely removed from the soil and the upper 17 feet of the open probe hole was backfilled with bentonite to form a seal between the ground surface and the HRC®. Upon completion of HRC® injection, all rods were removed and no physical pipe or conduit remained in the ground. This process was repeated for each of the injection points positioned upgradient from monitoring well MW-8S.

4.1.1 Pilot Test Results

Five individual groundwater sampling rounds were performed, and the first round of sampling was performed before HRC® injection to develop a basis for evaluating the effectiveness of HRC® to degrade PCP contamination. Table 4-1 provides a summary of the analytical results.

During the pilot test, PCP concentration decreased from 104,000 µg/L to 1,910 µg/L in a 281-day period. While the MCL of 1 µg/L for PCP was not achieved during the pilot test, a two order-of-magnitude decrease, or 98% reduction, in the PCP concentration was achieved.

4.2 Proposed Treatment Area

Based on the results of the pilot test, the concentration of PCP in groundwater can be reduced by an in situ application of HRC®. Since the pilot study was ended prior to exhausting all the HRC® in the aquifer, a definitive conclusion that HRC® can reduce PCP concentrations to levels that meet the MCL cannot be made. However, it is believed that HRC® can effectively reduce the existing PCP concentrations, which will also provide a reduction in the overall groundwater risk. Therefore, Illinois EPA directed E & E to develop an approach to implement HRC® injection. Based on the data generated during the EE/CA, a sitewide application of HRC® will be made into the PCP plume where concentrations are equal to or greater than 10 µg/L.

Typically, an HRC® application can stimulate biological degradation for up to 1 year. At the end of one year, the extent of PCP contaminated groundwater will be re-evaluated, and a determination as to whether an additional HRC® application is warranted to address those areas where the concentration of PCP exceeds 1 µg/L.

TABLE 4-1 SUMMARY OF HRC PILOT TEST ANALYTICAL RESULTS
30% REMEDIAL DESIGN
JENNISON-WRIGHT SUPERFUND SITE
GRANITE CITY, ILLINOIS

Analyte	Cleanup Objective	Sample Date				
		06/19/01	8/1/01	9/5/01	11/7/01	3/7/02
Groundwater Elevation (feet BGS)		**21.13**	**21.28**	**22.02**	**22.57**	**20.89**
Volatile Organic Compounds (μg/L)						
2-Butanone	NE	28.50	32.6	24.1	24.9	7.45 J
Acetone	NE	33.60	29.2	25.7	45.4	ND
Benzene	10	10.80	10.5	11	9.74	ND
Ethylbenzene	NE	21.30	20.0	20.9	23.3	ND
m,p-Xylene	NE	91.70	86.9	93.5	99.2	4.21 J
o-Xylene	NE	54.80	53.3	57.9	60.5	2.51 J
Total Xylene	NE	146.50	140.20	151.40	159.70	6.72
Styrene	NE	ND	ND	ND	2 J	ND
Toluene	NE	67.10	66.0	73	76.3	2.32 J
Trichloroethene	NE	6.62	6.31	8.18	11.5	2.58 J
Semivolatile Organic Compounds (mg/L)						
2,4,6-Trichlorophenol	NE	5.20 J	ND	ND	ND	ND
2-Methylnaphthalene	NE	520 E	477 J	436 J	531	64 J
Acenaphthylene	NE	5.08 J	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	NE	18.90	ND	ND	ND	ND
Dibenzofuran	NE	10.90	ND	ND	ND	ND
Fluorene	NE	30.40	ND	ND	ND	ND
Isophorone	NE	12.20	ND	ND	ND	ND
Naphthalene	400	354 E	310 J	ND	341 J	ND
Pentachlorophenol	1	104,000	101,000	83,200	54,300 J	1,910
Metals (mg/L)						
Iron	NE	38,200	36,900	34,600	43,000	4,180
Manganese	200	4,350	4,650	4,550	5,270	287
Other						
Sulfide (mg/L)	NE	ND	ND	1.4	4.4	2.0
pH	NE	7.10	6.5	6.5	6.7	6.6
Total Organic Carbon (mg/L)	NE	105	108	65.8	73.1	33.7

Key:

μg/L = Micrograms per liter.
J = Estimated concentration.
ND = Not detected.
NE = Not established.
E = Concentration exceeds calibration limits.
mg/L = Milligrams per liter.
NA = Not analyzed.
$CaCO_3$ = Calcium carbonate.
CO_2 = Carbon dioxide.

SUMMARY OF DETECTED PENTACHLOROPHENOL CONCENTRATIONS (μg/L)

SAMPLE DATE	MW-8S	GP1-HRC2	GP1-HRC3	GP1-HRC4	GP2-HRC4
06/18/01	104,000	N.S.	N.S.	N.S.	N.S.
08/01/01	101,000	100,000	N.S.	N.S.	N.S.
09/05/01	83,200	N.S.	30,600	N.S.	N.S.
11/07/01	54,300	N.S.	N.S.	54,700	26,400
03/27/02	1,910	N.S.	N.S.	N.S.	N.S.

N.S. = Not Sampled

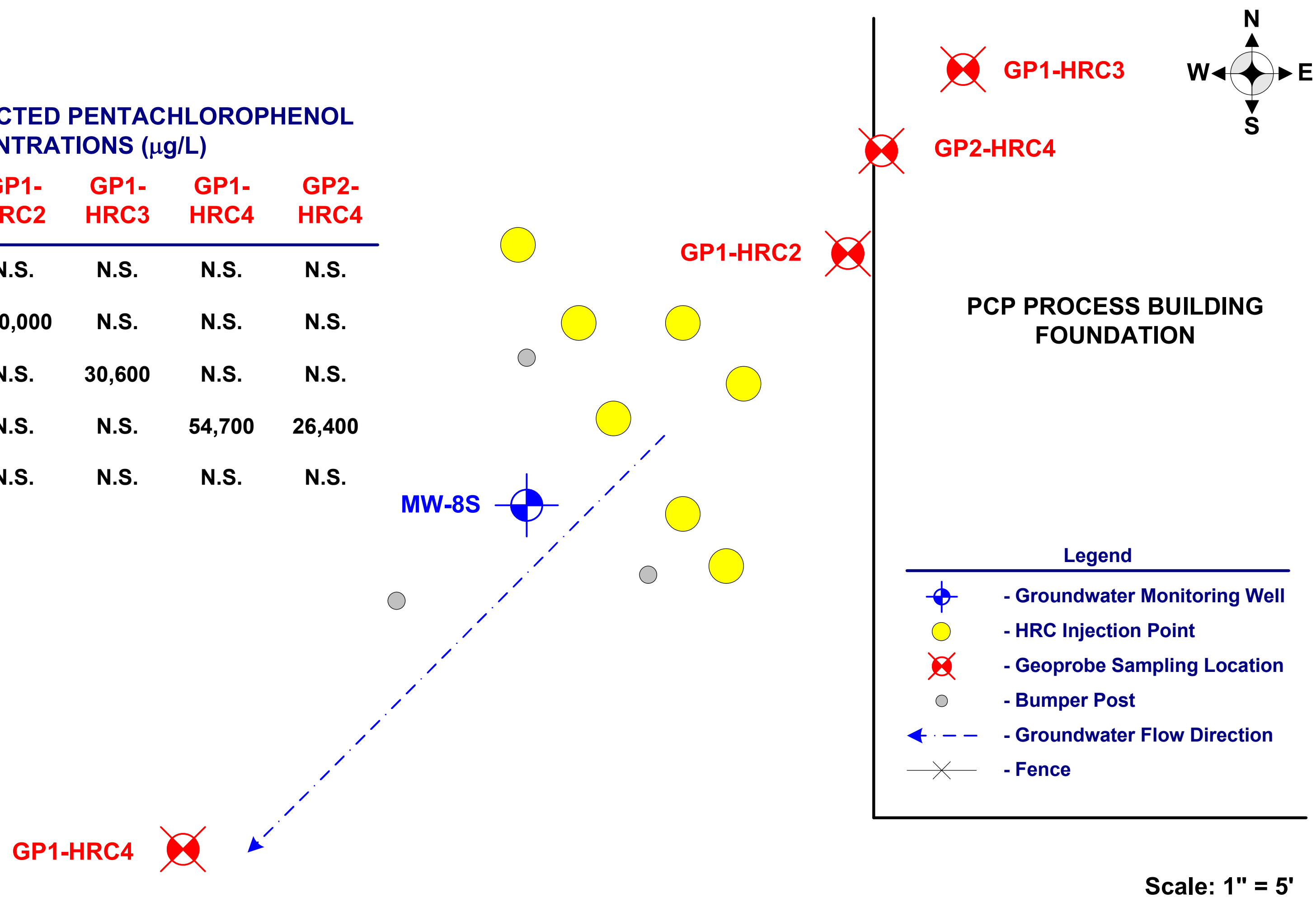


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Figure 4-1 HRC Sampling Locations and Analytical Results
30% Remedial Design
Jennison-Wright Superfund Site
Granite City, Illinois

5 Site Preparation

5.1 Removal and Disposal of Hazardous Wastes

RCRA
Resource Conservation and Recovery Act

BaP
benzo(a)pyrene

CFR
Code of Federal Regulation

TSD
treatment, storage, and disposal

IAC
Illinois Administrative Code

CY
cubic yards

Under the Remedial Action, excavation of soils and wastes will address the Resource Conservation and Recovery Act (RCRA) listed wastes, dioxin-contaminated soils, and soils posing a greater than 1E-4 cancer risk for benzo(a)pyrene. During the EE/CA, benzo(a)pyrene (BaP)-contaminated soil was found across the site. Based on a review of the analytical data generated during the EE/CA, it was found that by addressing soils with BaP concentrations that pose a risk greater than 1E-4, all other contaminants that exceed their 1E-4 threshold will also be addressed.

Applicable RCRA requirements covering the removal of any site soils and wastes include: 40 Code of Federal Regulations (CFR) 261.1-261.38, RCRA Identification and Listing of Hazardous Wastes; 40 CFR 268.1-268.50, RCRA Land Disposal Restriction; and RCRA §3004(e), Dust Suppression. Relevant and appropriate RCRA requirements include: 40 CFR 262.10-262.89, RCRA Standards Applicable to Generators of Hazardous Waste; 40 CFR 263.10-261.31, RCRA Standards Applicable to Transporters of Hazardous Waste; and 40 CFR 264.1-264.1202, RCRA Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TSD) Facilities. In addition, an applicable requirement for soils and wastes is Illinois Administrative Code (IAC) Title 35 Subtitle G, Waste Disposal.

5.1.1 Drip Track Waste

The entire site contains approximately 1,300 cubic yards (CY) of "drip track residue." The term "drip track residue" denotes F032- and F034-listed waste located beneath tram tracks. The estimate of 1,300 CY was obtained by estimating the length of tram track (excluding railroad track) at 6,795 feet and assuming a width of 4 feet and depth of 1 foot for contaminated soil. These contaminated areas, considered waste under RCRA, require incineration; specifically, 40 CFR 268.30 prohibits wood-preserving wastes from being placed into landfills. Drip track residue will be excavated, transported from the site as F032 and F034 waste, and incinerated at an approved off-site hazardous waste TSD facility. Excavation will be performed following the removal of rails and ties as described in Section 5.3. All visible waste material will be excavated to the width of the ties and to a depth of 9 inches. Waste material deeper than 9 inches and greater than 4 feet wide will be excavated on a case-by-case basis. The approximate location of the drip track residue is shown on Figure 5-1.

5.1.2 Dioxin-Contaminated Soil

Potentially, 5,600 CY of dioxin-contaminated soil will be addressed during the Remedial Action. The areas to be addressed were identified during EE/CA sampling. The approximate locations of these areas are shown on Figure 5-2; they include Area H, Area A (along the northern tramline), Area C (the PCP process area), the 22nd Street Lagoon, and an area south of the silos. Areas H, A, and C will be excavated to a depth of 1 foot. The 22nd Street Lagoon and the area south of the silos will have deep excavations of 8 feet. The soil will be transported from the site for incineration at an approved off-site TSD facility. Dioxin is prohibited from being placed into landfills under 40 CFR 268.31.

The bottoms of excavations will be screened for dioxins, using RapidScreen, to determine if dioxin concentrations are below site CUOs. RapidScreen is a lower-cost, rapid-turnaround screening method for detecting the toxic equivalency quotient for dioxin/furans in soil. RapidScreen does not produce false negatives and has a low false positive rate. A sample grid will be laid out over the excavated areas with 50-foot spacing between grid lines. Samples will be collected from the nodes of the grid and analyzed using the RapidScreen method. Areas of an excavation producing positive screening results will be further excavated. When all samples within an excavation indicate that CUOs have been met, investigative samples will be collected and analyzed using EPA Method 8290 or 1613. Validated analysis will be performed on the final excavation bottoms at all excavations. The number of samples analyzed will be equal to one-fifth of the number of samples analyzed using the RapidScreen method. The removal of contaminated soils will cease when the excavation is verified to be below site CUOs. Deep excavations (greater than 2 feet) will be backfilled with approved off-site borrow material. All shallow excavations will be graded to form smooth transitions with the ground surface around them.

5.1.3 Contaminated Soil

An estimated 38,000 CY of soil posing a cancer risk of 1E-4 for BaP concentrations is present on site. This includes the areas shown on Figure 5-2, in addition to estimated subsurface excavations near the former green building, former concrete basin, former white building, and Jennite pit.

5.2 Removal and Disposal of Transite Building

The transite building is a one-story heavy timber structure. Fifteen telephone poles, approximately 12 inches in diameter, serve as support columns for the rafters and framing. The roof is composed of asphalt shingles on wood sheathing and the walls consist of 4-foot by 8-foot transite panels hung on wood framing. The floor consists of 3-1/2-inch by 3-1/2-inch by 2-inch wood blocks on compacted earth. The footprint of this building covers 3,700 square feet. Upon demolition, the transite building will be reduced to approximately 100 cubic yards of wood studs, rafters, floor block, telephone support poles, and roofing material weighing 45 tons. The panels that constitute the walls of the transite building were found to contain 19% chrysotile asbestos. The panels, measuring 4 feet by 8 feet, are nailed to the wood framework of the structure. It is estimated that 5,000 square feet of paneling are present on the structure; Figure x-x identifies the location of the transite building.

The transite panels will be removed from the structure by a trained and certified asbestos abatement contractor. Panels that are deteriorated or crumbling will be sprayed with an encapsulant before and during removal, as necessary. The panels will be placed into a roll-off box that has been double-lined with plastic sheeting. Following the removal, the liners will be folded over the panels and completely sealed before the contents are transported to an off-site landfill for disposal. Applicable requirements for asbestos abatement include: 40 CFR 61.145, The National Emission Standard for Hazardous Air Pollutants (NESHAP), Asbestos Standards for Demolition; and IAC Title 77 Subtitle I Part 855, Illinois Department of Public Health Asbestos Abatement Act.

NESHAP
National Emission Standard for Hazardous Air Pollutants

Upon completion of the asbestos abatement, the building will be demolished and/or dismantled according to an approved demolition plan submitted by the contractor performing the demolition work. Demolition will proceed in the following order: interior gutting, roof removal, wall removal, and structural framing removal. The wood block flooring will be considered part of the building demolition and should be removed during the demolition process. The telephone poles may be pulled and/or excavated for removal. Demolition plans will include provisions for dust control. Construction debris will be transported to an off-site landfill for disposal. Applicable requirements for building demolition include RCRA §3004(e), Dust Suppression, and IAC Title 35 Subtitle G, Waste Disposal.

5.3 Steel Tram and Rail Line Removal

In order to address soils and wastes, as well as to implement remedial actions, it is necessary to remove the rail lines and associated wood ties. In 1990, steel rail was salvaged from the site; the location and amount of rail salvaged is not entirely known. The approximate locations of known or suspected rail lines are shown in Figure 5-1. It is suspected that some of the support zone gravel pad and gravel roadways built during previous removal actions were placed on top of existing steel tram, rail lines, and/or ties. It is estimated that there were formerly 6,765 linear feet of tramline and 4,630 linear feet of railroad line, for a total of 11,395 linear feet. This number equates to 22,790 total linear feet of steel rail.

Steel rail consisting of both railroad and tramlines that are located within the site boundaries will be removed and visually decontaminated. Decontamination will involve pressure-washing and scraping the rail at the decontamination pad to remove large chunks of debris. The rail will then be cut into lengths that can be transported and scrapped. Of the former 22,790 total linear feet of steel rail, it is estimated that 6,600 total linear feet remain on site.

5.3.1 Removal

Ties that remain after the removal of steel rail will be excavated. Chunks of soil that may be present on the ties will be removed by scraping. The ties will then be transported to an off-site landfill for disposal. It is estimated that there will be 400 tons of ties removed from tram and railroad beds. This number represents the amount of ties that would be associated with the former 11,395 total linear feet of rail line, since it can be assumed that ties were not removed when the steel rails were salvaged.

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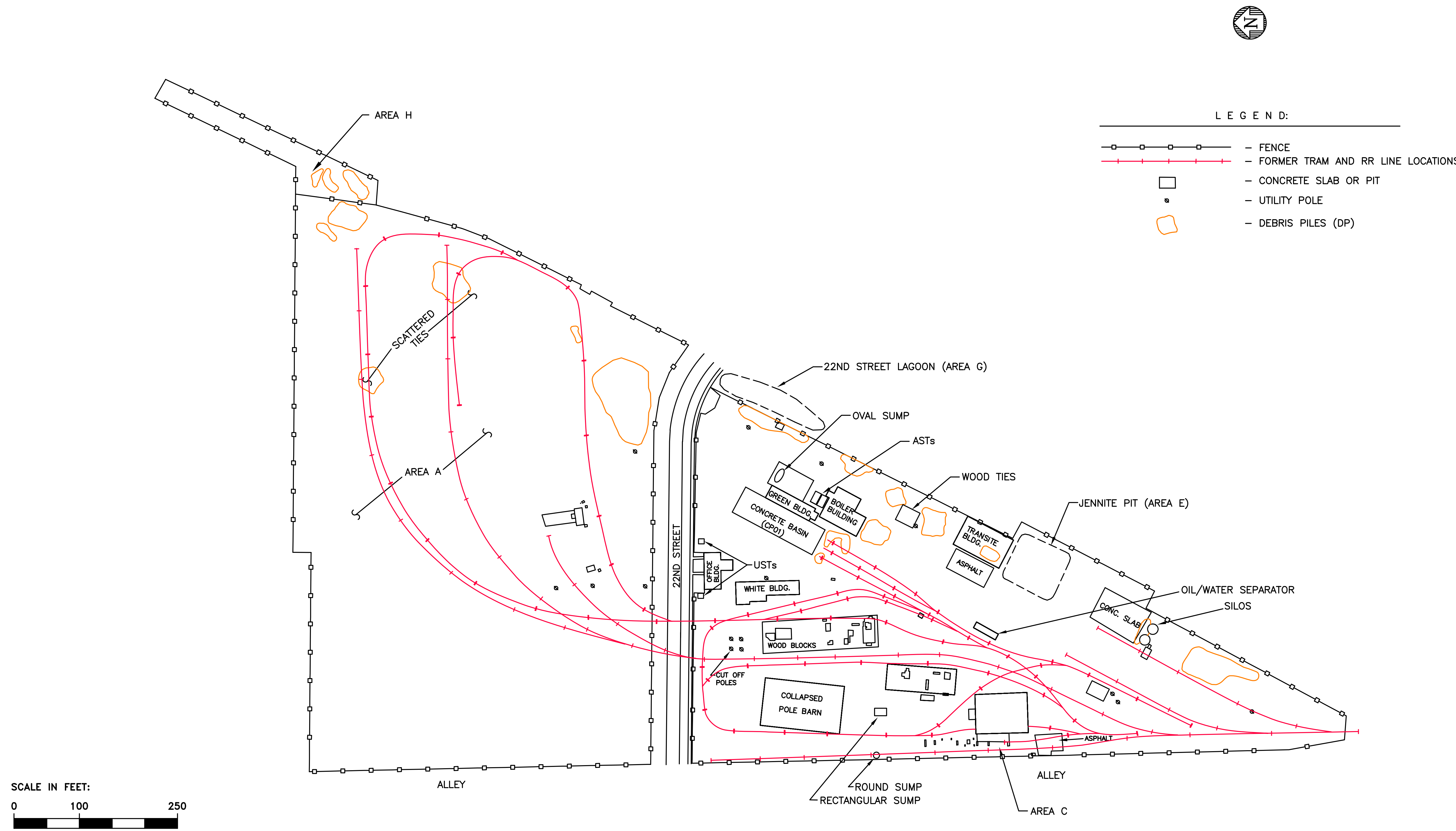

NO.	DATE	DWN	APP'D	DESCRIPTION

REVISIONS

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International Specialists in the Environment

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DRAWN BY	APPROVED BY
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FIGURE 5–1
FORMER TRAM/RAILROAD LINE MAP
JENNISON–WRIGHT SITE
GRANITE CITY, MADISON COUNTY, ILLINOIS

SCALE	DATE ISSUED	C.A.D. FILE NO.	DRAWING NO.	REV.
SEE ABOVE	APR 2002	IE1S101B.DWG	5–1	

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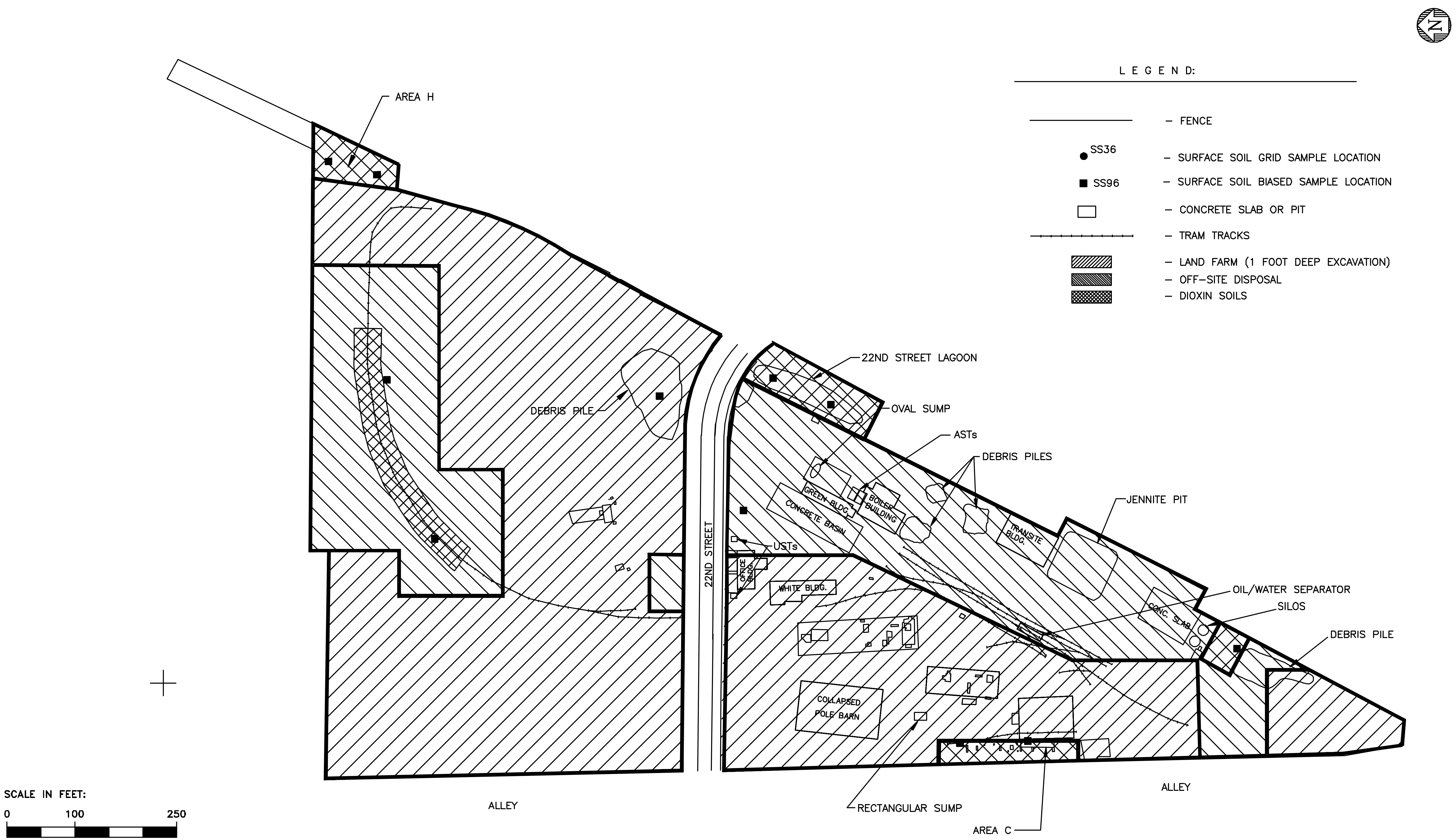

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Figure 5-2 SURFACE SOIL EXCAVATIONS
JENNISON-WRIGHT SUPERFUND SITE
GRANITE CITY, ILLINOIS

6 Proposed Design of Treatment Systems

6.1 NAPL Extraction and Groundwater Treatment System

In this section of the design report, the locations and placement of the equipment necessary to facilitate the removal of NAPL from the 22nd Street Lagoon area is presented. Figure 6-1 provides a schematic for the locations of the various components that comprise the NAPL extraction and treatment system.

6.1.1 Injection and Extraction Wells

In order to determine the appropriate number of NAPL extraction and heat injection wells, E & E performed groundwater capture calculations and enlisted the help of WRI, patent holder for the CROW® technology.

gpm
gallons per minute

Based on our calculations, E & E determined that a single groundwater extraction well pumping at a rate of 20 gallons per minute (gpm) would be capable of capturing the entire NAPL area as defined in Section 3. Given that reducing the potential for heat loss in the subsurface aquifer is an essential design parameter, an additional (second) groundwater extraction well is proposed to reduce the groundwater travel time between the injection and extraction points.

Using the approximate horizontal boundaries of the NAPL treatment zone, WRI recommended that a five-point overlapping grid system be implemented. Therefore, a total of six injection wells will be installed. By using the five-point grid system and placing the injection wells at the NAPL plume boundary, the approximate distance between an injection well and extraction well would be 90 feet.

6.1.2 Header and Process Piping

Based on the location of the individual injection and extraction wells, the header pipe system to connect the individual wells to the process equipment has been located. For the injection system, the main header pipe will be connected to the process boiler and will provide heated water to the injection wells. As shown on Figure 6-1, the six injection wells will provide heated water through three branch lines connected to the main header.

For each extraction well, a branch header emanating from the well will be tied directly to a main header, which will tie into the process treatment system.

6.1.3 Equipment Building

The equipment building is the location that will house the boiler, all groundwater treatment equipment, and controls. As shown on Figure 6-1, it has been centrally located to minimize the length of piping runs, which reduces heat loss and installation costs.

6.2 Land Treatment Unit

A land treatment unit (landfarm) will be constructed to treat soils that fall between the 1E-05 and 1E-04 surface soil cancer risk for BaP based on future worker exposure scenario. Soils that exhibit cancer risks associated with BaP concentrations greater than 1E-04 will be transported off site for disposal; soils that present a 1E-05 or lower cancer risk for BaP concentrations will not be addressed during remediation. The exception to this will be that the entire site will have 1 foot of soil removed from the surface. This will occur after dioxin-contaminated soils, RCRA wastes, and soils posing risks greater than 1E-04 have been excavated. The 1-foot surface layer will be excavated to within 1 foot of the fenceline in areas that have not already had soils excavated (i.e., where the original soil surface is present). Generally, areas where building foundations were once present will not be excavated, although this decision will be based on sample results gathered following the removal actions performed during the Limited Remedial Action and on the presence of imported fill material.

The bottom of excavation areas that had a cancer risk between 1E-04 and 1E-05 before excavation will be sampled. The samples will be collected from the nodes of a 100-foot by 100-foot grid and analyzed for PAHs using EPA Method 8310. Soil exceeding the 1E-04 cancer risk criteria will be transported off site; soil between the 1E-04 and 1E-05 cancer risk will be further excavated. The volume of soil to be treated on site is approximately 25,000 CY. The volume was calculated by determining the surface area as plotted on a map depicting cancer risk from BaP concentrations and using an excavation depth of 1 foot (see Figure 5-2). BaP concentrations are taken from analytical results of the surface soil sampling presented in the EE/CA. The EE/CA surface soil samples consisted of 81 samples collected on a 100-foot by 100-foot grid and 11 biased soil samples not defined by the grid system. Any excavations deeper than 1 foot will result in additional material to be treated.

The landfarm will consist of a treatment cell, soil staging pad, retention pond, equipment shed, water treatment building, and decontamination pad. Figure 6-2 provides the general layout for the land treatment unit. The components of the landfarm are all described in further detail in the subsequent sections of this document. Soils meeting the selection criteria will be excavated and, if not immediately placed into the landfarm treatment cell, will be stockpiled on the eastern side of the north portion of the site. A staging pad will be constructed for this purpose.

6.2.1 Land Treatment Cell

FSL
feet above sea level

The topography of the north area of the site consists of a gradual slope beginning at the western edge of the fence line 420.3 feet above sea level (FSL) and descending to 416.1 FSL at the northeastern fence line. The drop in elevation would be from 419.3 FSL to 415.1 FSL when 1 foot of soil is excavated. The difference in elevation will be beneficial in the design and construction of the landfarm cell. The drop in elevation will aid in drainage of the treatment cell and reduce the amount of dike construction necessary along the northwest corner of the cell. The elevation of the treatment cell will drop approximately 2.38 feet from the southern to the northern edge and approximately 0.48 feet from the western to the eastern edge to achieve a 0.5% and 0.1% grade, respectively. The existing drainage pattern will also aid in drainage to the retention pond. The retention pond with its associated piping is discussed in Section 6.2.3. Figure 6-3 provides typical cross-sectional views of the land treatment cell. The landfarm cell will consist of one cell sized 475 feet by 480 feet, capable of treating 8,450 CY over a 1-year period with the material spread to a depth of 1 foot. Based on the estimated volume of 25,000 cubic yards, it will take three years to treat the selected soils.

The cell will be constructed by grading existing soils to achieve the proper grade along the subbase of the treatment cell. Proper grading will promote drainage and minimize ponding and erosion within the cell; grading is especially important in the St. Louis area where high-intensity rainfall is common. The subbase will be covered with a 1½-foot layer of recompacted clay to form an impervious base. The clay will be graded with 100% of the material passing through a 1-inch sieve, 80% passing through a

U.S. #4 sieve, and 70% passing through a U.S. #200 sieve; a liquid limit between 30 and 60; and a plasticity index between 15 and 40. The clay will be disced, harrowed, or kneaded as necessary to break down clods, and placed within 5% of the optimum moisture content in 6-inch compacted lifts (9 inches before compaction). Each lift will be scarified before placing succeeding lifts. The base will be covered with a 1½-foot drainage layer. The drainage layer shall consist of well-compacted, well-graded gravels and coarse sand, with a minimum compacted hydraulic conductivity of 3.28E-4 feet per second.

Soil to be treated will be preprocessed to remove large rocks and debris. It will then be placed upon the drainage layer to a 1-foot depth. If more contaminated soils are present on site than originally estimated, then the depth of the treatment layer may be amended. It is possible to treat a deeper layer of soil if the tilling apparatus can reach the depth of the bottom soils, the soil is composed of large amounts of sand, and drainage remains good. It will be important to maintain the initial grade, which will be obscured over time by tilling operations. Upon verification that the first loading has been treated to meet the site CUOs, a second layer of soil will be placed upon the original layer. The second loading will then be treated. Following the second loading, the soil will be removed and the third loading will be placed upon the treatment cell bed. By leaving the initial soil layer in place, the top of the drainage layer will not be subjected to scarring or damage associated with the removal of soil. This provides an overall cost savings to the project.

Perimeter dikes will maintain the shape of the cell and will prevent runoff of contact water. The perimeter dikes shall contain the volume of the design storm, assuming that no water may be removed to storage. The perimeter dikes will also be sized to prevent floodwater run-on and overtopping as a result of current or wave run-up for the 25-year flood. A minimum of 1.9 feet of freeboard shall be maintained from the top of the dike to the surface of the first layer of contaminated soil. The dike will be at a minimum 5 feet 9 inches tall from the subbase of the landfarm cell. The dike will have a 3-foot tabletop, the interior slope will be 1:1, and the exterior slope will be 3:1 to the point where it meets existing ground surface. The 3-foot-wide tabletop will allow the dike to be walked for inspections. The exterior toe of the dike will level out to form an area surrounding the treatment cell that will be wide enough to drive a vehicle. This area will be seeded.

The dike will be constructed by grading the existing on-site soils to match the intended shape. If the amount of cut soil exceeds the amount of fill needed to grade and form the perimeter dike, then the perimeter "roadway" can be moved to the top of the dike. This will result in a 10-foot-wide tabletop on the top of the dike that may extend most of the way around the treatment cell. The interior slope of the perimeter dike will be covered with 1 foot of clay that ties into the clay liner of the base, using clay matching the same description as the base. The top and exterior of the dike will be seeded. On-site soils can be used if they are capable of supporting vegetation by placing them uncompacted on the surface of the dike. If the soil used in the dike is not capable of supporting vegetation, then the surface should be covered with imported topsoil.

6.2.2 Soil Staging Pad

A soil staging pad will be constructed in the northern portion of the site along the eastern fence line. The pad will be built to stockpile 25,000 cubic yards of contaminated soil (the amount of soil that is to be treated in the landfarm cell). The base of the soil staging pad will be approximately 200 feet by 250 feet. The base of the pad will consist of a 40-mil-thick chemical-resistant, impermeable, geomembrane liner with a 1% or greater grade toward a collection sump. The base will be surrounded by a 2-foot-tall clay dike with 1:1 side slopes. The base will be constructed so that it drains to the northwest corner of the pad. The staging pad will prevent soil contaminants from being carried off site with contact water.

The soil stockpile will be covered with a 10-mil-thick ultraviolet- and chemical-resistant, impermeable, geomembrane liner. The cover will prevent soil from becoming wind-borne and carried off site during dry conditions.

The elevation of the ground surface after 1-foot excavations in this area of the site will be from 421 FSL to 416 FSL. The elevation drops from south to north towards the location of the retention pond.

6.2.3 Retention Pond

A collection, conveyance, and storage system will remove all contact water from the design storm within a 24-hour period plus 10% to account for antecedent storage capacity. A retention pond will be constructed on the northern portion of the site to accept runoff from the landfarm cell and the soil staging pad equal to a 25-year, 24-hour storm. The pond will be constructed 100 feet wide by 300 feet long by 4.80 feet deep. It will be oriented in an east-west direction along the northeastern corner of the site. The pond will be lined with a 110-mil HDPE lining. The elevation of the ground surface in this area is approximately 515 FSL. Based on the elevation of this area compared to those of the landfarm cell and staging pad, all drainage to the retention pond will be accomplished through gravity flow.

Flow from the landfarm cell will be through the sand layer to a collection lateral. The collection lateral will be located on the north side of the treatment cell and will drain to the northeast corner of the cell. The collection lateral will consist of a 250-foot 6-inch slotted pipe leading to a 230-foot 8-inch slotted pipe that empties into the collection sump. Two cleanout sumps will be located along the length of pipe run: one at the beginning of the pipe run and one where the pipe size changes. The piping will lie near the bottom of a drainage layer of coarsely graded gravel. Geotextile fabrics (especially non-woven) form an attachment site and substrate for biological activity. Consequently, no geotextile fabric of any kind will be used in the lateral trench because of relatively quick clogging. Eight-inch piping from the collection sump will enter the western side of the retention pond. The piping will have a shutoff valve so that, if necessary, contact water can be stored in the landfarm cell.

Flow from the soil staging pad will gravity-drain across the surface of the pad to a collection sump. The collection sump will then drain by gravity to the southwestern edge of the retention pond through an 8-inch pipe.

6.2.4 Laydown and Storage Area

All-weather surfaces shall be provided for laydown and storage areas. Areas shall be constructed with dimensions large enough to house equipment and materials necessary for site operation and maintenance (amendment and tilling equipment storage), as well as water treatment equipment.

6.3 In Situ Groundwater Treatment

As stated in Section 4, the in situ application of HRC® using a Geoprobe will be used to reduce the concentration of PCP in the site groundwater. Based on the findings of the pilot test, HRC® has demonstrated its ability to reduce PCP concentrations at the JW site. Working with Regenesis, E & E used the pilot test data to develop an overall application strategy to address areas of PCP contamination without NAPL.

In developing the overall HRC® application strategy, the following assumptions were used:

- The plume to be treated is approximately 1,600 feet by 300 feet;
- The average PCP concentration across the plume is 1,910 µg/L;
- Contaminated saturated zone thickness requiring treatment is 15 feet; and
- Groundwater velocity is 40 feet/year.

Given that the PCP plume is widespread, a barrier-based application would be applied. Barriers will serve three functions; they will: 1) reduce the size of the plume; 2) contain and control further contaminant migration; and 3) provide the most cost-effective application.

Using this approach, eight HRC® barriers and a total of 200 injection points are proposed. Figure 6-4 shows the locations of the barriers. Within each barrier, two rows of injection points will be made. Table 6-1 provides a summary of the barrier length, delivery point spacing, and dose rate. Finally, the barriers will also be placed approximately 10 feet upgradient of a data point (i.e., monitoring well or Geoprobe location), so a determination of the effectiveness of the HRC® application can be made.

6.3.1 Hydrogen Release Compound Injection

The HRC® will be injected into the soil through steel rods using a piston pump. Specifically, a Geoprobe direct-push system and high-pressure piston-driven grout pump will be used to inject the HRC®. A steel probe rod fitted with an expendable tip will be advanced to the proposed depth. The probe rod will then be slightly retracted to dislodge the expendable tip from the probe rod. The expendable tip will remain in the ground. HRC® will then be pumped through the open-ended probe rod into the soil as the rod is retracted. The rods will then be completely removed from the soil and the upper section of the open probe hole will be backfilled with bentonite to form a seal between the ground surface and the HRC®. Upon completion of HRC® injection, all rods will be removed and no physical pipe or conduit will remain in the ground. This process will be repeated for each of the injection points.

6.3.2 Monitoring Wells

It will be necessary to place nine additional groundwater monitoring wells near the HRC® injection sites for monitoring purposes. The wells will be located as shown on Figure 6-4.

ID
inside diameter

HSA
hollow stem auger

The monitoring well borings will be drilled using a truck-mounted drill rig equipped with a 4.25-inch inside diameter (ID) hollow stem auger (HSA). The bit end of the auger string will be fitted with a knockout plug, and the HSAs will be advanced directly to a completion depth of 25 feet BGS. No subsurface soil samples will be collected during the well boring installations. Soil cuttings generated during the drilling activities will be added to the soils to be landfarmed.

The monitoring wells will consist of 2-inch ID, Schedule 40, PVC riser pipe and screen with threaded, flush joints. The screens will be 10 feet in length with a 0.010-inch slot size. All well materials will be decontaminated using a steam cleaner prior to installation. A filter pack consisting of washed, sieved silica sand will be placed in the annular space surrounding the well screen, and extended to approximately 2 feet above the top of the screen. A high-percentage solids bentonite grout will be tremie-placed from the top of the filter pack to within 3 feet of ground surface. A 5-foot-long protective steel casing with lockable cap will be placed over the well and cemented in place to provide well security. A sloping concrete pad will be installed at the ground surface to prevent surface water infiltration around the protective casing.

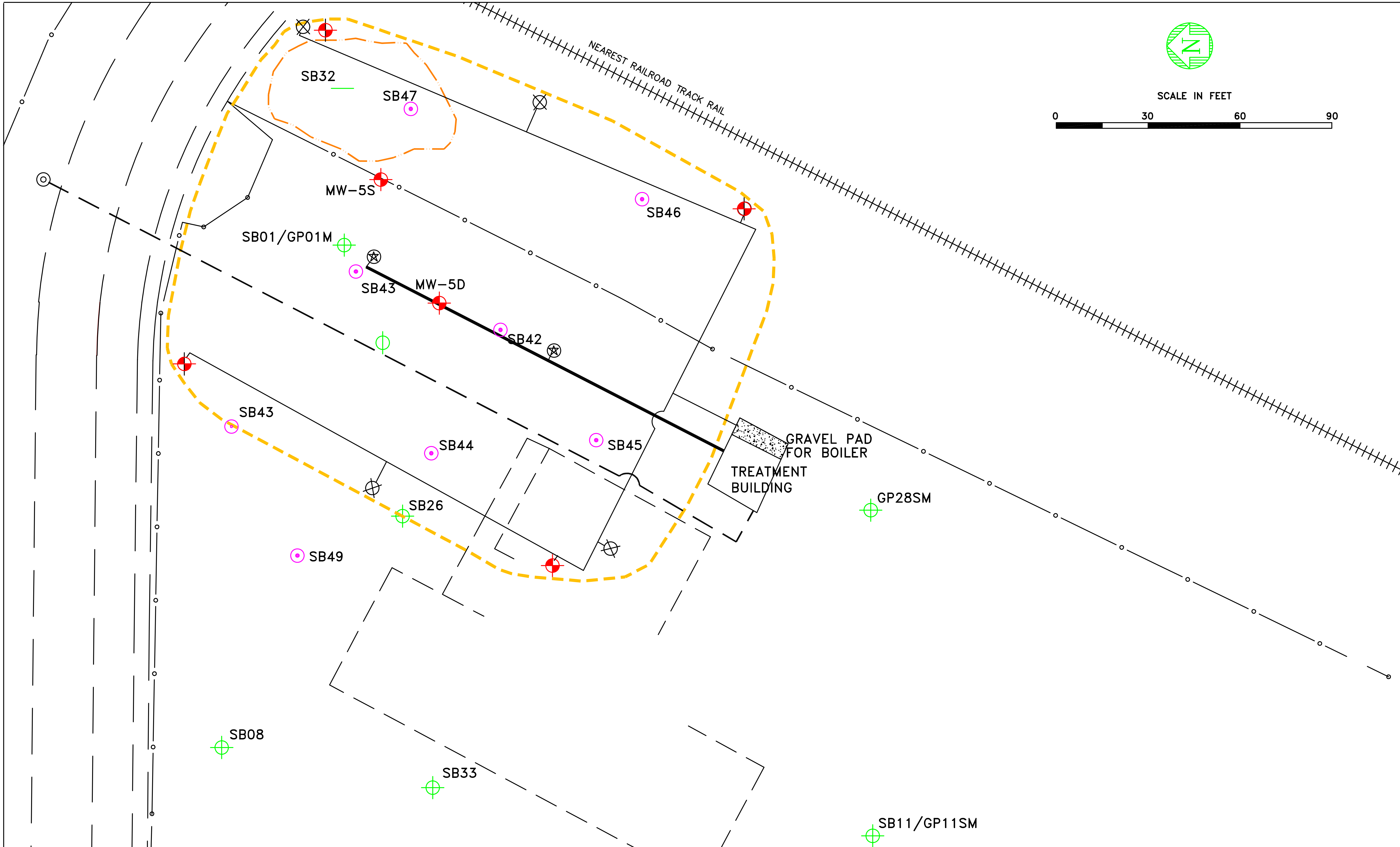
The monitoring wells will be developed using a bailer or submersible pump. Development will be considered complete upon the removal of a minimum of five well volumes and/or stabilization of temperature, specific conductance, pH, turbidity, and dissolved oxygen.

Table 6-1 Summary of HRC Treatment Barriers
30% Remedial Design
Jennison-Wright Superfund Site
Granite City, Illinois

Barrier	Length (feet)	Total Injection Points	Spacing (feet)
1	150	20	15
2	240	32	15
3	150	20	15
4	210	28	15
5	210	28	15
6	90	12	15
7	90	12	15
8	150	20	15
9	60	8	15
10	150	20	15

HRC Injection Rate: 4 pounds/linear foot

Key:
HRC= Hydrogen Release Compound



LEGEND:

EXISTING MONITORING WELL LOCATION	HOT WATER INJECTION WELL
10" DIA. HDPE INFLUENT PIPE	GROUNDWATER EXTRACTION WELL
1" DIA. BLACK IRON PIPE	FENCE
2" DIA. HDPE EFFLUENT LINE	MANHOLE

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DESIGNED BY N. BROWN	CHECKED BY C. LIN
DRAWN BY R. SLAUGHTER	APPROVED BY N. BROWN

FIGURE 6-1
NAPL EXTRACTION SYSTEM LAYOUT
JENNISON-WRIGHT SITE

GRANITE CITY, MADISON COUNTY, ILLINOIS

SCALE	DATE ISSUED	C.A.D. FILE NO.	DRAWING NO.	REV.
SEE ABOVE	MAY 2003	IE1S001B_6-1		

CHI plotted: 11/14/2000 RES

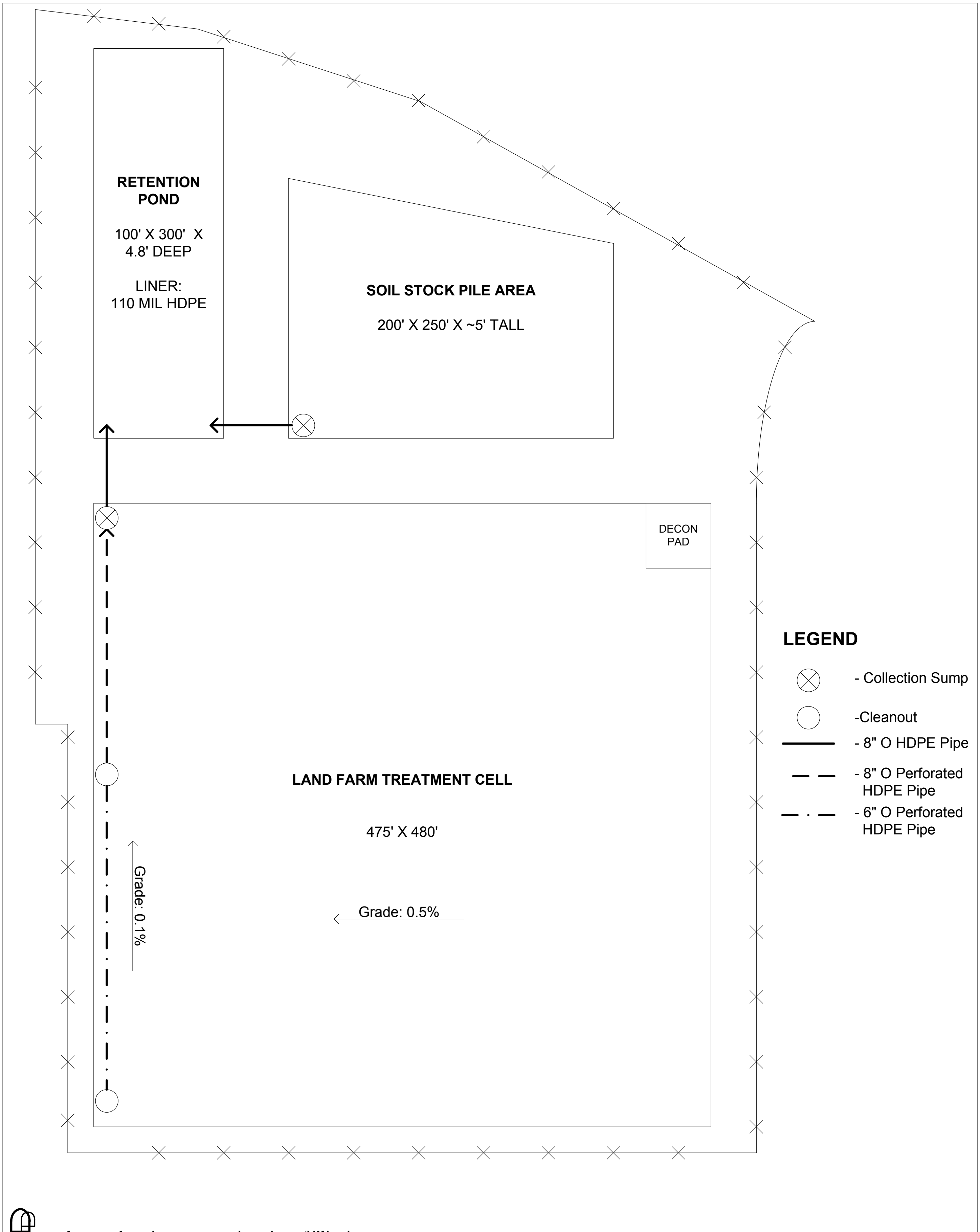

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Figure 6-2 PROPOSED SITE LAYOUT
LANDFARM TREATMENT CELL
JENNISON-WRIGHT SUPERFUND SITE
GRANITE CITY, ILLINOIS

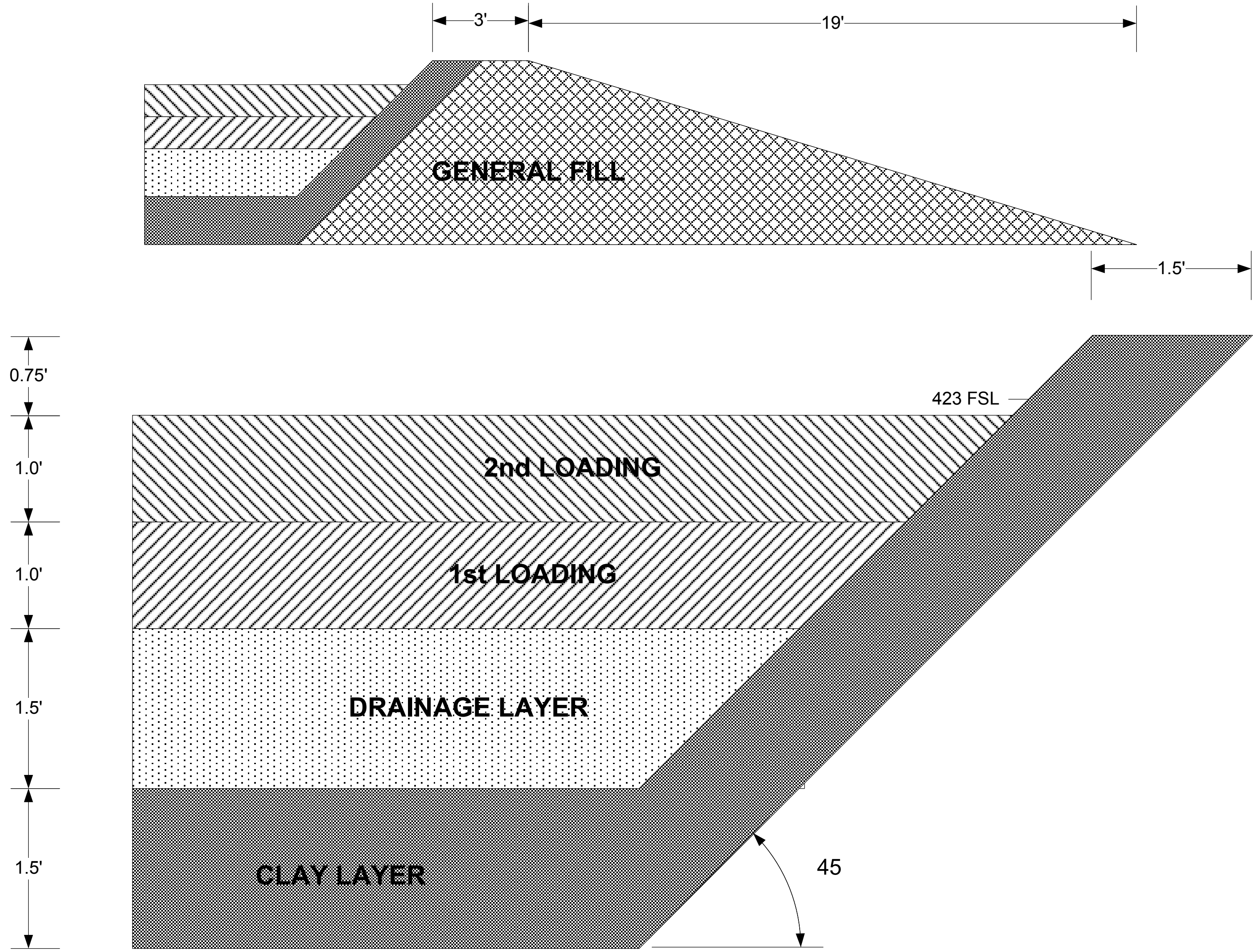

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Figure 6-3 TYPICAL CROSS SECTIONS LANDFARM TREATMENT CELL
30% REMEDIAL DESIGN
JENNISON-WRIGHT SUPERFUND SITE
GRANITE CITY, ILLINOIS

IQ6S112B

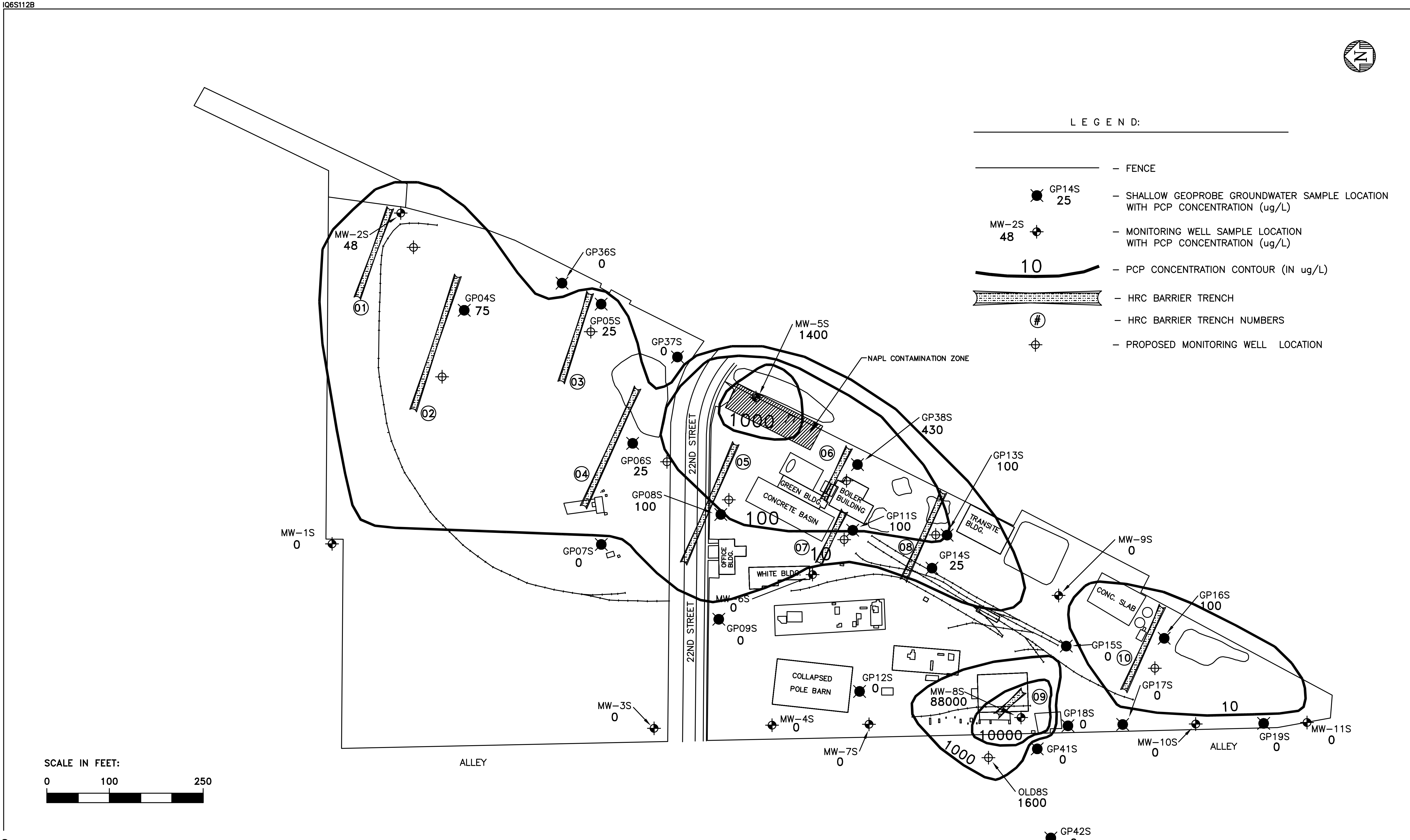

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Figure 6–4 LOCATIONS OF HRC TREATMENT BARRIERS
JENNISON–WRIGHT SUPERFUND SITE
GRANITE CITY, ILLINOIS

7 Process Equipment

In this section of the 30% Design Report, the process equipment and controls required for a fully functional NAPL extraction and treatment system, and landfarm treatment system are presented. In the following subsections, the major pieces of equipment and components of each individual system are identified and design assumptions are stated.

Equipment suppliers for the NAPL extraction and treatment system typically provide prepackaged systems. These systems include the boiler and associated controls. The final bid package is anticipated to specify a single vendor to supply the treatment system with the associated controls. The bid package will state the minimum performance requirements and construction materials. The selected construction contractor will be allowed to recommend substitutions but will not be permitted to implement them without written approval from the designated oversight engineer.

7.1 NAPL Extraction System

7.1.1 Injection Wells

The injection wells will be constructed of 6-inch-diameter pipe, set in a 10-inch-diameter borehole. The total depth of each injection well will be 90 feet BGS, and the wells will be 0.010-inch slotted screen with the screened interval starting at the water table and extending to a depth of 90 feet BGS. By screening the entire water column, the injection system will be more flexible, allowing for modifications as to which depths can be heated within the aquifer.

Within each injection well, two black iron injection “stingers” will be installed. Hot water will be injected into the aquifer through the individual stingers. The stingers will be constructed of 1-inch-diameter black iron pipe. One stinger will discharge heated water at approximately 50 feet BGS, and the second will discharge at a depth of 85 feet BGS. A thermal packard will be placed in the well at a depth of 60 feet BGS to ensure a more even injection of heated water through the aquifer.

The injection well heads will be housed within a protective vault. In order to control the injection rate, each stinger will be equipped with a gate valve and an access port to measure flow rate. The vault will be placed so that the top of the vault will be at ground surface.

7.1.2 Extraction Wells

The extraction wells will be constructed of 4-inch-diameter HDPE pipe, set in an 8-inch-diameter borehole. The total depth of each extraction well will be 90 feet BGS, and the wells will be 0.010-inch slotted screen with the screened interval starting at the water table and extending to a depth of 90 feet BGS. Within each well, a submersible pump will be placed at a depth of 85 feet BGS. The pump will be capable of sustaining a pumping rate of 20 gpm with a head of 150 feet (water).

At ground surface, a protective vault will be placed over the extraction well. The purpose of the vault is to allow access to the pump to facilitate its removal for maintenance and/or repair. No controls or measuring devices will be installed in the extraction well head piping or vault. Pumping rates will be monitored in the equipment building.

7.1.3 Header Piping

Black iron pipe will be used for all header piping associated with heat injection. HDPE pipe will be used as the header pipe for the NAPL extraction system and effluent discharge piping. Depending on the flow rate for a given section of piping, multiple-diameter pipe will be used. For the purpose of this design report, it has been assumed that a 2-inch-diameter pipe will be used. The individual sections of the header pipe will be sized to minimize frictional losses associated with transferring either the heated fluids or the extracted NAPL/groundwater mixture.

ASTM
American Society for Testing and Materials

All process piping (from the wells to the equipment building) will be installed below grade. The final design will specify the appropriate trench dimensions, bedding materials, and backfill procedures. At a minimum, the process piping will be buried approximately 2 feet below grade. Additionally, the final design will specify the appropriate American Society for Testing and Materials (ASTM) methods for joining pipe, as well as the methods for joining different types of materials.

7.1.4 Heat Generation

E & E, in conjunction with WRI, evaluated multiple methods of introducing heat into the aquifer to facilitate NAPL extraction. Based on the injection flow rates and ability to minimize the amount of water that will require treatment, a hot water generation system was selected.

This system is a self-contained skid-mounted unit that does not require placement in a building. The unit contains a heat exchanger, steam boiler, air condenser, boiler water storage, and all necessary process controls. Figure 7-1 contains a schematic of the hot water generation system. These units vary in size, and the unit selected for the JW site measures 8 feet wide by 20 feet long.

Feedwater for the hot water generating system will come from the groundwater treatment system. By using a heat exchanger, only the NAPL has to be removed prior to being heated.

7.2 Groundwater Treatment System

POTW
Publicly Owned Treatment Works

The groundwater extraction rate for the NAPL recovery system has been estimated to be 40 gpm. E & E, with WRI, has determined that approximately 10% of the 40 gpm (i.e., 4 gpm) will be considered excess. This excess groundwater will be treated and discharged to the Granite City Publicly Owned Treatment Works (POTW). The following subsections described the components associated with the groundwater treatment system, and Figure 8-1 provides a piping and instrumentation diagram for the groundwater treatment system.

7.2.1 Oil/Water Separator

As the heated NAPL/groundwater is extracted, it will be necessary to separate the two liquids. Based on data obtained during the predesign effort, the NAPL will be denser than water and will sink. Therefore, a DNAPL/LNAPL type oil/water separator has been selected for this application. This type of unit allows light NAPLs to be skimmed off the top, and dense NAPLs to be siphoned off the bottom, letting groundwater flow through the center.

While an extraction flow rate of 40 gpm has been selected, the oil/water separator will be sized to handle a flow rate of 50 gpm. Based on these parameters, a Hydroflo Technologies Model ES024-SS21P has been specified.

Finally, the oil/water separator will be installed approximately 6 feet above grade. This will allow for the NAPL to gravity-drain into the NAPL storage tank.

Estimation of NAPL Generation

Based on the EE/CA and predesign field investigations, the NAPL present in the 22nd Street Lagoon area is not readily mobile. Hot water injection was selected to increase the mobility and capture rate of NAPL. While heating will increase the mobility of the NAPL, it is still difficult to determine the NAPL collection rate. In order to be conservative, a 1,000-gallon holding tank will be installed to collect the extracted NAPL. The tank will be equipped with a high-level alarm to prevent overfilling and spills. The tank will be outfitted with a drain port to facilitate loading of the NAPL into tank trucks for transportation to a disposal facility. For estimating purposes, it has been assumed that approximately 7,500 gallons of NAPL will be extracted per year.

7.2.2 Clay Filter

While biological treatment was originally selected by the EE/CA as the means to treat the groundwater, E & E has determined that the use of an organoclay would provide a more cost-effective and less labor-intensive method for removing emulsified oil and organic contaminants. Organoclay has the capacity to adsorb up to 60% of its own weight in contaminants. Assuming a 400-pound canister is used, a total of 288 pounds of contamination could potentially be removed.

Assuming a flow rate of 4 gpm, using the groundwater data for MW-5S presented in Section 3, and assuming that the organoclay can absorb 50% of its weight in contaminants, it has been estimated that a single canister would provide approximately 50 days of treatment.

As with carbon systems, a 100% backup unit has also been proposed. By having backup, the treatment system can continue to operate after the first canister of clay is spent. Additionally, the clay system will be valved such that changeout will be relatively straightforward.

GAC
granulated activated carbon

7.2.3 GAC System

The purpose of the organoclay is to remove the majority of emulsified contaminants. However, in order to ensure that the requirements of the POTW are met, the use of a granulated activated carbon (GAC) system has also been incorporated.

The GAC system will be identical to the clay system except that GAC will be used.

7.2.4 Equipment Building

Since a relatively small treatment system is required and the hot water generation system does not need to be placed in a protective shelter, a prefabricated building will be used in lieu of designing a dedicated groundwater treatment building.

The building will be 20 feet wide by 20 feet long by 10 feet high. The container box will have two 8-foot-wide by 8.5-foot-high steel doors on both ends. Additionally, the building will be insulated and heated to prevent freezing and allow for the transfer of NAPL to a tank truck during the winter.

7.3 Process Control Implementation

To ensure continuous operation of the NAPL extraction and treatment systems, process control instrumentation is a critical component of the overall system. The design will be required to be fully automatic and remotely controlled. Process control components include, but are not limited to, the control panel, alarms, temperature controller, and remote telemetry.

7.3.1 Control Panel

NEMA
National Electrical Manufacturers Association

PLC
programmable logic controller

The control panel will be located in the equipment building. The control panel will be specified to comply with National Electrical Manufacturers Association (NEMA) 4X specifications. The panel will be sized to allow for future expansion. Boiler temperatures, current meters, flow meters, set-point inputs, and hand/off/auto switches will be mounted on the face of the control panel.

Within the control panel, the programmable logic controller (PLC) will be installed. The PLC will receive all signals associated with controlling the NAPL extraction and treatment system and will control equipment operations automatically.

Finally, as a site safety precaution, the control panel will be equipped with an emergency shutdown or "kill" button. This will allow an on-site operator to completely shut down all components of the systems by pushing a single button. The system will remain locked out until it is reset manually.

7.3.2 Sensors and Alarms

To ensure proper and safe operation of the NAPL extraction and groundwater treatment systems, critical process items will be monitored by sensors that will trigger the remote telemetry system and initiate system shutdown when operating parameters are not met.

For the hot water generation system, the following parameters will be monitored:

- Steam temperature;
- Steam pressure;
- Water temperature; and
- Electric current (extraction pump motors).

For the groundwater treatment system, the following parameters will be monitored:

- Flow rate;
- Electric current (pump motors);
- High level (NAPL storage tank); and
- Pressure differential (clay and GAC systems).

7.3.3 Remote Telemetry System

O & M
operation and maintenance

LTU
land treatment unit

A remote telemetry system is an automatic dialing alarm system that will notify the operation and maintenance (O & M) contractor in case of system failure (e.g., low or high temperature in the boiler or full NAPL storage tank). The remote telemetry system will be specified to allow an operator to call into the system.

7.4 Land Treatment Unit

7.4.1 Tillage Equipment

The remedial action contractor will supply the required equipment for tilling (aerating and mixing) the land treatment unit (LTU) soil. At a minimum, the equipment will include a tractor and disk harrow that are sized so tilling of the entire treatment area can be done in one day or less. A tractor-mounted rototiller may also be used to till the soil. A rototiller will increase the amount of mixing that takes place in the soil. Any equipment used will be required to reach the depth of the soil loading without causing damage to the drainage layer.

7.4.2 Water Distribution Equipment

The remedial action contractor will supply the required equipment for irrigation of the LTU. A water wagon with retractable arms shall be used. It will be preferable for the wagon to make as few trips across the surface of the treatment cell as possible. Fewer trips will prevent soils within the LTU from being compacted.

Pumps and hoses used to fill the water wagon from the retention pond shall be supplied by the remedial contractor. The contractor shall have a source of additional water available if the amount available in the retention pond is inadequate to irrigate the entire soil loading.

7.4.3 Water Treatment Equipment

Water treatment equipment will include filter housings and a carbon vessel. The equipment should be sized to enable the treatment of an approximately 20-gpm flow from a trash (or similar type) pump.

7.4.4 Decontamination Equipment

The remedial action contractor will supply the required equipment for the decontamination of equipment exiting the treatment cell of the LTU. The equipment will include a portable power washer that can be used for decontaminating the equipment that is used in the treatment cells.

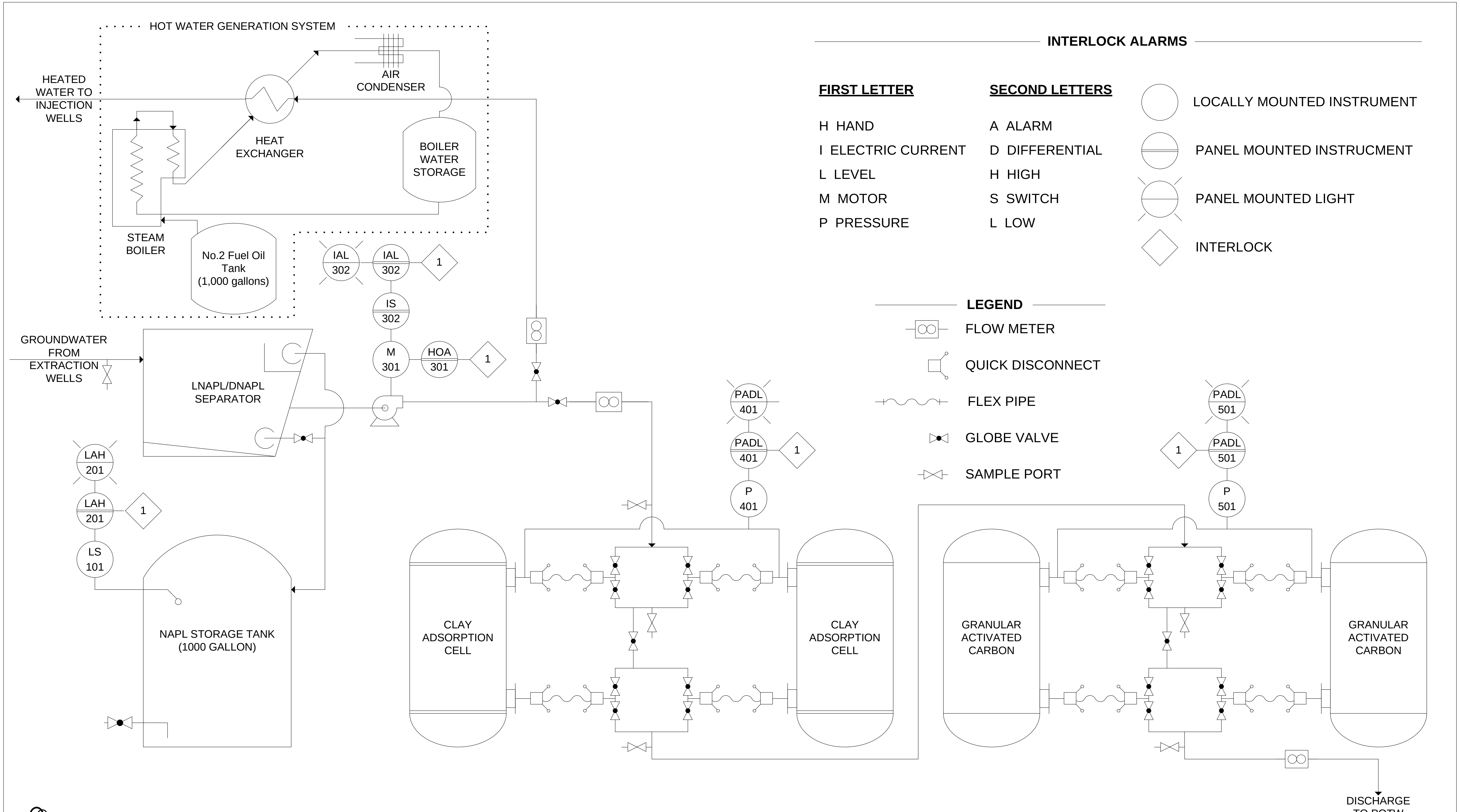

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FIGURE 7-1 **PIPING AND INSTRUMENTATION DIAGRAM**
NAPL EXTRACTION AND TREATMENT SYSTEM
30% REMEDIAL DESIGN
JENNISON-WRIGHT SUPERFUND SITE
GRANITE CITY, ILLINOIS

8 Operation and Maintenance

In this section of the 30% Design Report, O & M activities associated with the NAPL extraction and treatment system, LTU, and in situ groundwater treatment monitoring are presented.

The requirements for an O & M plan will be provided in the final specifications. The O & M plan will provide for implementation, startup, shutdown, emergency shutdown, operation of systems, long-term maintenance, scheduled preventive maintenance, safety requirements, a complete list of all mechanical equipment and recommended spare parts, testing requirements to assess system performance, and records and reporting requirements.

8.1 NAPL Extraction Operation & Maintenance

The final specifications for the NAPL extraction and groundwater treatment systems as presented in this report provide for a system that will require little O & M. O & M associated with the systems will mainly involve logging of data, changeout of spent organoclay and GAC, arranging for the off-site disposal of the spent filter media and collected NAPL, and pump maintenance.

8.1.1 Data Acquisition and Reporting

VOC
volatile organic compounds

SVOC
semivolatile organic compound

Influent and effluent sampling and analysis will also be included as part of the O & M regime. This data will be used to demonstrate compliance with the local POTW requirements. On a monthly basis, an influent and effluent sample will be collected and submitted for volatile organic compounds (VOC) and semivolatile organic compound (SVOC), pH, metals, and oil and grease analysis. The effluent data will then be reported to the Granite City POTW.

On a bimonthly basis, VOC and SVOC samples will be collected between the two clay units, immediately after clay treatment, and between the GAC units. This data will be used to determine the effectiveness of the individual treatment units and may be used to estimate the life expectancy of the individual clay and GAC canisters.

In addition to sampling and analysis, a daily log of operating parameters will be kept. Key items such as injection water temperature, flow rates, and volume of NAPL recovered will be maintained. The final specifications will spell out the requirements for a checklist, as well as a schedule for performing maintenance activities.

8.1.2 Length of Operation & Maintenance

The NAPL extraction and treatment systems will be operated until the amount of NAPL recovery does not justify operating the system. It is uncertain as to how long the system will actually be operated. Therefore, the final specifications will require that the remedial contractor operate the system for a minimum of one year. The specifications will further spell out that the Illinois EPA will have three 1-year extension options. Therefore, the NAPL system could readily be operated for up to a four-year period using the same contract. For cost estimating purposes, it will be assumed that the NAPL extraction and treatment system will be operated for three years. In addition, it has been assumed that the seven clay canisters, three GAC canisters, and 15,000 gallons of NAPL will require disposal on a yearly basis.

An operator will be required to be at the site providing O & M activities. The time spent on site will vary based on the current needs. For estimating purposes, it has been assumed that an operator/technician will be on site for 20 hours per week.

8.2 LTU Operation & Maintenance

O & M of the landfarm will include nutrient addition, pH control, tilling, and moisture addition. Sampling and analysis of soil from the treatment cell will include assessment of CUO attainment, nutrient concentrations, and microbial activity (population and species). O & M will also include mowing and inspection of the perimeter dike, inspection of the retention pond, inspection of staging pad liners, testing of contact water used for irrigation, and treatment and disposal of excess or unsatisfactory contact water.

8.2.1 Nutrient Addition

A field soil test kit should be used for analyzing macronutrient (nitrates, o-phosphate, and potassium) and micronutrient (nitrites, ammonia, sulfates, calcium, magnesium, and iron) levels. The contractor will need to supply the field test kit and nutrient amendment necessary for maintaining the correct soil nutrient

ppm
parts per million

S.U.
standard units

NaOH
sodium hydroxide

content. At a minimum, soil nutrient content should be tested bimonthly. Nitrogen should be added to the soil using pelletized urea nitrogen 47-0-0, to maintain a nitrate-nitrogen level of greater than 30 parts per million (ppm). It is anticipated that the addition of 1 pound per cubic yard of pelletized urea nitrogen 47-0-0 will need to be added each time that the treatment cell is aerated. The level of o-phosphate should be greater than 3 ppm. Other nutrients will be added as needed. Slow-release fertilizers should be used when possible. For the first four times that nutrient field testing is performed, a minimum of two samples shall be tested in accordance with EPA Method 9056 for nitrate, o-phosphate, nitrite, and sulfate; EPA Method 6010B for potassium, calcium, magnesium, and iron; and Standard Method 4500 for ammonia. The laboratory-tested samples will be performed to verify the field method.

8.2.2 Soil pH Monitoring and Adjustment

A hand-held soil pH meter should be used to maintain the pH in the range of 6.0 to 8.5 standard units (S.U.), with 7.0 S.U. being preferred. Adjustment of the pH may be necessary if the soils become too alkaline or acid. However, acclimated populations of microbes may sustain adequate degradation rates when the pH is as low as 5.0 S.U. without the need for adjustment.

The Contractor will need to supply the instrumentation and soil additions necessary for maintaining the correct soil pH. At a minimum, soil pH should be tested monthly. Each time a pH adjustment agent has been applied, the soil pH should be tested that same day, and seven days following application. For the first four times that pH field testing is performed, a minimum of two samples shall be tested in accordance with ASTM D 4972 to determine the pH, and to verify field method.

Agricultural spreaders or other devices may be used to apply pH adjustment agents to the treatment cell. Over time, biological degradation of organic constituents may result in a reduction of pH in soils. Crushed limestone or lime will be used to raise pH. In soils that are alkaline and require downward adjustment, elemental sulfur will be used. Aqueous caustics, such as sodium hydroxide (NaOH), shall not be used as pH adjusting agents. Strong caustics should not be used because they can cause large, rapid changes in soil pH, which may inhibit biological activity. The goal of pH adjustment is to improve the soil's buffering capacity by adjusting the pH in small increments. A field test kit should be used to determine the amount of pH adjustment agent to be added. Amendments used to adjust the pH should be added in conservative, calculated doses.

8.2.3 Tilling

The treatment cell should be tilled once every month to a depth no greater than 12 inches. The direction of tilling should be alternated with the initial pass in the direction of the main gradient (north-south) and with a second pass in the opposite direction (east-west). Tilling should not occur within 48 hours of a rainfall or irrigation event that saturates the soil. Tilling too soon after precipitation or irrigation may lead to the formation of hard clods, especially if the soil exhibits a high clay content. The direction of tilling should be alternated to facilitate thorough mixing and homogenous treatment of contaminated soils. The Contractor will supply the equipment necessary for this task.

8.2.4 Moisture Monitoring and Addition

Soil moisture should be monitored in the field using a field moisture meter. The soil should be kept between 60% and 80% of water-holding (field) capacity. The Contractor will need to supply the instrumentation, water, and irrigation equipment necessary for maintaining the correct soil moisture content. At a minimum, soil moisture content should be tested weekly. Before treatment of each loading, a minimum of four representative composite samples shall be tested in accordance with ASTM D 425 to determine field capacity. For the first four weeks and every 12 weeks thereafter, a minimum of two samples per week shall be tested in accordance with ASTM D 2974 or ASTM D 2216 to determine moisture content, and to verify field methods. These samples shall be collected immediately after testing using the field method, and in the same location where the field method testing was performed.

The quantity of water from each field precipitation event shall be measured and recorded at least every day that moisture content testing is performed. The treatment cell shall be irrigated when testing indicates that the moisture content is below 60% of field capacity. Contact water present in the retention pond may be used for irrigation. Although it is possible for nitrate, ammonia, and o-phosphate levels in recycled irrigation water to reach toxic levels, pH levels and the accumulation of salts are usually of much greater concern. Specific conductance is an indicator of salt content. Therefore, the pH and specific conductance of the water will be tested every time before being used as irrigation water. Water with a pH less than 5.5 or greater than 9, or a specific conductance greater than 15 mho, should not be used. If the recycled irrigation water is unusable, it shall be treated and discharged to the sanitary sewer. The contractor shall provide irrigation water when a sufficient quantity is not available on site. Irrigation water, if obtained from a public water system, will need to be treated to remove residual chlorine concentrations before use. Irrigation should not exceed an application rate greater than 0.5 inch per hour. Irrigation should be ceased if ponding water is observed in the treatment cell.

8.2.5 Sampling and Analysis

8.2.5.1 Cleanup Objective Monitoring

BTEX
benzene, toluene, ethylbenzene, and xylene

Initially, and for every three months thereafter, sampling shall be conducted to determine if CUOs are being achieved. Analysis will consist of EPA Method for benzene, toluene, ethylbenzene, and xylene (BTEX), and EPA Method 8270 for semivolatile organic compounds including PCP. For each sample, one five-point composite shall be collected for every 1,000 CY in the treatment cell. This equates to eight samples each quarter.

8.2.5.2 Bacteria Population Monitoring

Initially, and every three months thereafter, the treatment cell shall have four samples collected and analyzed for total colony-forming units. The samples will consist of five-point composites from the four quadrants of the treatment cell. If required, the soil can be spiked with the bacterial culture RBC TPH-OX from Interbio, Inc. The culture is specifically formulated for degradation of PCP and may be placed dry at a rate of 1.0 pound per CY. However, indigenous organisms generally have a better survival rate than inoculated organisms, which are not as well adapted to the environment.

8.2.6 LTU Integrity Inspections

The physical construction (berm, liner, etc.) and operation (drainage system) of the landfarm should be inspected weekly. The berm will be walked to inspect for damage from rodents or erosion. In addition, the treatment cell and soil staging pad will be inspected to ensure that proper drainage is occurring. The collection lateral cleanouts, sumps, and retention pond will be checked for standing water and debris. No water will be allowed to overflow onto the ground surface, but will be contained within the trenches and pond.

8.2.7 Vegetation Management

The grass areas surrounding the landfarm cell and improved areas of the site shall be mowed whenever the grass reaches 12 inches in height. Grass shall be mowed from beneath the perimeter fence; herbicides shall not be used. Woody plants should be prevented from growing on the perimeter dike and should be removed immediately if identified.

8.3 Groundwater Sampling

Ten monitoring wells will be sampled to provide data to assess the effectiveness of HRC® and to identify any temporal contaminant trends in groundwater at the site.

Each well will be sampled quarterly for one year, including once prior to HRC® injection. The HRC® is projected to release its useful hydrogen after one year.

COD
chemical oxygen demand

DO
dissolved oxygen

ORP
oxidation-reduction potential

NTUs
nephelometric turbidity units

To quantify the potential for site conditions, other than petroleum-related hydrocarbons, to consume oxygen, E & E will submit a groundwater sample for chemical oxygen demand (COD). Static water level measurements from the well will be collected on all four occasions that well sampling is conducted. In addition, the field analytical parameters for dissolved oxygen (DO), pH, turbidity, specific conductance, and oxidation-reduction potential (ORP) will be collected.

Prior to sample collection, each well will be purged until the measurements of specific conductance, pH, temperature, turbidity, and DO stabilize for three successive readings. Field measurements of these parameters will be taken after each successive liter is removed during pumping. Pumping rates will be within the range of 0.1 to1.0 liters per minute. The following values are acceptable maximum ranges for each of the parameters:

- Specific conductance (temperature-corrected) ±20% of the reading range;
- pH ±0.5 standard unit;
- Temperature ±2°C;
- Turbidity less than 20 nephelometric turbidity units (NTUs) or within 20% NTU; and
- Dissolved oxygen within 20%.

A peristaltic pump, capable of obtaining low flow, with disposable silicone and polyethylene tubing will be used for purging and sample collection. Tubing will be lowered to the approximate midpoint of the well screen for purging. In the event that the well does not recharge fast enough to allow less than 1 foot of draw-down, the well will be pumped dry and the sample will be collected when the well has recharged to a sufficient level that an adequate sample volume can be obtained.

Sampling personnel will take precautions against cross-contamination when using one piece of sampling equipment for a series of samples. Before and after each sample is collected, sampling equipment will be decontaminated. Sample collection procedures are as follows:

HSP
health and safety plan

- Wear appropriate health and safety clothing/equipment as outlined in the health and safety plan (HSP). Place clean plastic sheeting around the well;
- Unlock and remove cap. Use a PID or FID to monitor air at the well head;
- When the PID or FID indicates background organic vapor readings at the well head, measure the static water level in the well;
- Lower the tubing from the peristaltic pump into the well. The tube intake will be placed at the midpoint of the screen while purging using a pump flow rate of approximately 1 liter per minute, or less;
- Measure sample temperature, pH, specific conductance, turbidity, ORP, and DO;
- When transferring water from pump tubing to sample jars, avoid agitating the sample, which promotes the loss of volatile constituents. Collect samples for volatile analysis first;
- Record physical characteristics of the groundwater (e.g., color, odor) observed during sampling;
- Cool samples on ice to 4°C;
- Seal, label, and pack sample jars for shipment to the laboratory; and
- Record data in the field logbook; complete chain-of-custody forms and other paperwork.

Duplicate groundwater samples will be collected simultaneously in equal volumes from the same location with the same sampling equipment and placed into identical containers. Duplicate groundwater samples will be preserved and handled in the same manner as all other groundwater samples.

Field and laboratory personnel will follow proper sample collection and handling protocols. Water samples will be packaged, preserved (where applicable), and shipped to the selected laboratory, in accordance with standard operating procedures.

Water generated during purging will be added to decontamination water or sent through on-site treatment systems.

9 Additional Design Considerations

9.1 Well Abandonment

During preparation of the site for selected remedial alternatives, several monitoring wells will require abandonment. If a well is slated for abandonment, the well or piping will have all exposed portions removed to a depth of 2 feet BGS. All bollards and concrete pads will also be removed. The remaining piping will then be filled with bentonite-cement slurry and the open end will be capped. The areas around each well will then be backfilled level with the existing ground surface using clean borrow material.

For construction of the LTU's retention pond, it will be necessary to abandon MW-2S. MW-2S is 24 feet deep.

For deep soil excavations, MW-5S, MW-5D, MW-6S, MW-6M, MW-6D, MW-8S, and MW-8M will require abandonment. These wells are 28, 114, 31, 65, 114, 25, and 57 feet deep, respectively.

In addition to the wells listed above, severely damaged wells, obsolete wells, or open piping may be encountered on the site. If this occurs, the locations will be flagged so that they may be observed by Illinois EPA personnel. Illinois EPA personnel will then determine if the locations are to be abandoned.

9.2 Drill Cutting and Miscellaneous Debris Disposal

Drill cuttings will be generated during the installation of new monitoring wells for groundwater remediation monitoring and from the installation of extraction and recovery wells for the NAPL extraction system. All drill cuttings will be placed into the LTU.

Concrete, bollards, etc., will be staged until they can be transported as construction debris to an off-site landfill.

CHASP
Contractor health and safety plan

CFR
Code of Federal Regulations

CAMP
Contractor Air Monitoring Plan

9.3 Health and Safety

Each contractor and/or subcontractor working on site will prepare a site-specific health and safety plan to govern their activities in relation to the specifications. The Contractor health and safety plan (CHASP) will be required in accordance with Occupational Safety and Health Administration Standards and Regulations contained in 29 Code of Federal Regulations (CFR) 1910 and 29 CFR 1926.

9.4 Site Security

The selected remedial action contractor will be responsible for site security for protection of their equipment and materials that are stored on site.

9.5 Decontamination Water

Water used during decontamination activities will flow toward the sump of the existing decontamination pad where it will be transferred by a submersible pump to a holding tank. The holding tank will be discharged to the sanitary sewer as necessary to avoid overflow.

An estimated 5,000 gallons of decontamination water will be generated during the site preparation activities. Additional water will be generated during the O & M phase of the LTU each time the tractor or water/nutrient wagon exits the treatment cell. The water will drain to the treatment cell and be collected by the drainage system. The decontamination water will then be analyzed, treated, and disposed of. Treatment and disposal will be the responsibility of the remedial contractor.

A source of decontamination water will be identified by the contractor for use during the construction and removal phases of the remedial action.

9.6 Air Emissions

The contractor shall develop and submit a Contractor Air Monitoring Plan (CAMP). The CAMP shall include provisions for fugitive dust monitoring and control, as well as asbestos abatement sampling.

Personal air sampling will be specified in the site-specific health and safety plan, not in the CAMP.

PCB
polychlorinated biphenyl

9.7 Borrow Material

Excavations more than 1 foot deep will be backfilled with an approved off-site borrow material. Borrow material will not contain large rocks, debris, waste, or vegetation. The selected remedial action contractor will have borrow material tested for polychlorinated biphenyls (PCBs), VOCs, SVOCs, and metals concentrations greater than TACO Tier 1 residential standards. The contractor will submit borrow material samples and their testing results to the Illinois EPA. The source of borrow material will be made available for inspection by Illinois EPA or another source will be found.

9.8 Site Survey

A site survey will be conducted at the completion all field activities and will include the locations of fences, existing utilities, monitoring wells, and any other site features. The survey will also provide site contours at 1-foot intervals.

9.9 Access Agreements

Work at the 22nd Street Lagoon will be located off site, on the property of the Granite City, St. Louis & Eastern Belt Line Railroad, and possibly the Norfolk and Western Railway Company. The same situation may occur during removal of transite sheets from the eastern side of the transite building. Both situations will require a signed access agreement from the railroad companies to perform the work. Work occurring within 25 feet of an active rail line will also require the use of a railroad spotter. The spotter will need to be hired from the railroad company by the remedial contractor.

9.10 Bank Stabilization Along Railroad

The excavation of the 22nd Street Lagoon will be located off site, on the property of the Granite City, St. Louis & Eastern Belt Line Railroad and the Norfolk and Western Railway Company. The excavation will be located adjacent to existing and active rail lines and will be approximately 8 feet deep. For this reason, the bank adjacent to the tracks will need to be stabilized. The selected remedial contractor will be responsible for the site investigation, design with approval of a structural engineer registered in the State of Illinois, and construction. The stabilization material shall consist of cantilever or anchor sheet piling.

10 References

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